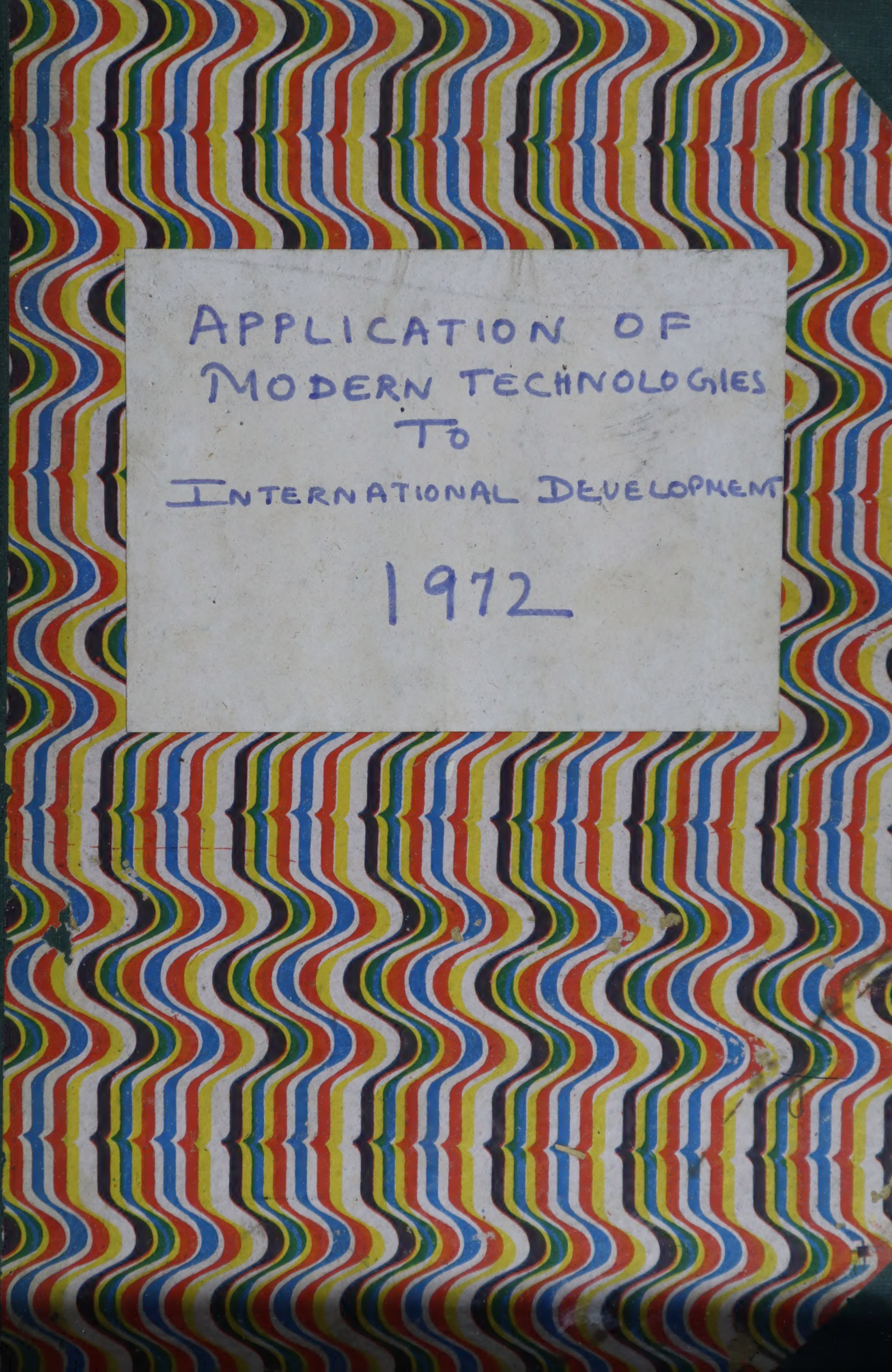

APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT

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APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT

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Office of Science and Technology
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INTRODUCTION

This issue of *Application of Modern Technologies to International Development* is the first in a new publication series sponsored jointly by the Agency for International Development and the National Technical Information Service (NTIS), United States Department of Commerce. The purpose of the series is to increase the ready availability of U.S. technical publications of special interest in developing countries to scientists, engineers, and planners in industrial and technological research institutions, universities, and government agencies to foster the transfer of technology to these countries.

The reports described herein, representing the results of research sponsored by the United States Government, were selected for their relevance to development needs mainly in three general subject areas: Chemistry; Materials; and Mechanical, Industrial, Civil, and Marine Engineering. All of the reports listed may be purchased by the reader from NTIS at nominal cost. See order form for ordering information.

Application of Modern Technologies to International Development will be issued quarterly. The publication is in an experimental stage and suggestions as to how it may be made more useful will be most welcome. Other addresses that the reader may wish to furnish will be considered in expanding our circulation list.

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HOW TO USE THIS PUBLICATION

As a matter of convenience, the report descriptions are arranged according to general subject area. These subject classifications are somewhat arbitrary; furthermore, each entry appears only once in the publication, even though it might logically have been placed in more than one classification. The user is thus invited to scan the entire publication for items of possible interest.

Prices of the reports, listed by order number, appear on page 73.

ABOUT NTIS

The Commerce Department's National Technical Information Service is the central point in the United States for public sale of research, development and other Government-funded reports prepared by Federal agencies, their contractors, or grantees.

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REVIEWS IN RARE EARTHS. A COMPILATION OF BOOKS, CHAPTER OF BOOKS, JOURNAL ARTICLES, REPORTS, CONFERENCE PROCEEDINGS AND BIBLIOGRAPHIES PUBLISHED FROM 1946 TO 1968

Ames Laboratory, Rare Earth Information Center. C. C. Bertrand, and K. A. Gschneider, Jr. June 1969. 87 pages

IS–RIC–3

The bibliography is composed of about 500 references on the chemistry, physics, metallurgy, geology, mineralogy, and industrial uses and applications of rare earths. Subject and author indexes are included. Most of the material was published in the period 1946–1968, but there are a number of references both earlier and later than this.

* * *

BIBLIOGRAPHY OF SELECTED METAL HYDRIDES

Mound Laboratory. B. F. Hammond, and H. R. Ratcliffe. February 1970. 36 pages.

MLM–1673

The bibliography includes references to the alkali, alkaline earth, transition metal, rare earth, thorium, and uranium hydrides. Most of the material was published in the period 1950–1968. The references were collected from all of the major relevant journals, patents, special reports, and other bibliographies. A subject index is included.

* * *

TRENDS IN USAGE OF RARE EARTHS

National Materials Advisory Board. October 1970. 83 pages.
PB–196 330

Although the rare earths have been known as a group of elements since around 1800, most of them defied separation and identification as individual elements until the 1920's. Separation techniques developed in the 1940's made them available for more extensive study, and applications have been found in such areas as catalysts, phosphors, lasers, magnets, and nuclear materials. In the study reported in this document, a panel of rare-earth scientists (chemists, physicists, metallurgists, geologists) who deal with these elements in production, utilization, and fundamental research on their properties has considered the status of the elements in relation to sources, production, costs, and utilization. In addition, projected uses for these materials in the near future and in the more distant future (25 years) are presented, together with some possible substitute materials where such exist.

* * *

TRENDS IN THE USAGE OF FLUORSPAR

National Materials Advisory Board. December 1970. 69 pages.

PB–198 339

Large quantities of fluorspar are consumed by the steel, aluminum, and chemical industries. A continued supply of fluorspar is clearly required for the production of metals and materials that are of vital importance to modern industrial society. The document is the result of a study directed to the estimation of the trends in fluorspar usage up until 1980. Particular attention has been paid to the possible effects of changing technology on the needs of the largest consuming industries.

* * *

Organic Chemicals

PERCHLOROCARBON POLYMERS

Dow Chemical Company. Harold E. Doorenbos. November 1969. 76 pages.

AD–702 840

The Spaniard, M. Ballester has synthesized and studied a family of perchlorinated alkaromatic compounds which possess some rather remarkable properties. The document describes work undertaken to accelerate the exploitation of these compounds. The complete chlorination of dialkyl-substituted aromatics was achieved on a practical scale in high yield with good conversion. It was also found that the polymers and copolymers of the compounds can be easily prepared by a new polymerization technique to give products which, in some cases, have good thermal stability. A preliminary examination of the possible utility of the compound yielded the following applications: high-temperature matrix materials for glass fiber laminates; fairly flame-retardant moistureproofing treatments for cotton and other cellulosic fabrics; stabilizers for extreme pressure lubricating oils; and substances with limited biological activity, especially against powdery mildew.

* * *

PHYSICAL PROPERTIES OF SULFUR COMPOUNDS (C1-C13)

Bureau of Mines, Petroleum Research Center. W. E. Haines, R. V. Helm, and Janice L. Stephens. October 1969. 255 pages.

PB–193 342

PHYSICAL PROPERTIES OF SULFUR COMPOUNDS. A LITERATURE REVIEW OF HIGHER MOLECULAR-WEIGHT COMPOUNDS THROUGH 1955

Bureau of Mines, Petroleum Research Center. R. V. Helm. October 1969. 119 pages.

PB–193 343

PHYSICAL PROPERTIES OF SULFUR COMPOUNDS. A LITERATURE REVIEW—1956–1960

Bureau of Mines, Petroleum Research Center. R. V. Helm. October 1969. 143 pages.

PB–193 344

The reports present tables of physical properties of sulfur compounds found in petroleum, namely thiol (mercaptans), sulfides (thioethers), disulfides, and thiophenes. The tables include all compounds Cl through Cn except those compounds that have atoms other than carbon, hydrogen, and sulfur. The literature was searched from 1840 through 1960. The properties tabulated are boiling point, density, refractive index, and freezing point. References are given for such properties as viscosity, vapor pressure, surface tension, and thermodynamic functions.

Process Control

PROCEEDINGS OF THE ANNUAL WORKSHOP ON THE USE OF DIGITAL COMPUTERS IN PROCESS CONTROL (4TH) FEBRUARY 12–14, 1969

Louisiana State University, Department of Chemical Engineering. Cecil L. Smith. 1969. 140 pages.

AD–696 178

The document is comprised of the 15 papers presented at the Workshop. Topics include: Computer hardware testing; CODIL, a new language for process control programming; design and implementation of control systems utilizing cathode raye tube display consoles; role of the systems contractor; power station digital computer applications; software evaluation; the simplex technique for achieving and maintaining near-optimal operating conditions; analytical computer and satellite terminals; acquisition and processing data from pilot plants; advanced control in the process industries; improving performance of digital control loops; pulse-width-modulated control; prediction of control value characteristics; project management and computer control; solution of process control problems by experimental methods; batch process control communication systems; decision making considerations in process control installations; critique of a batch unit computer control project.

PRODYC: A SIMULATION PROGRAM FOR CHEMICAL PROCESS DYNAMICS AND CONTROL

Cullen College of Engineering, University of Houston. Don M. Ingels, and R. L. Motard. August 1970. 261 pages.

AD–714 250

The spectrum of present day methods for the investigation of chemical processes ranges from pilot plant studies, to the collection of operating data in actual industrial plants, to the development and use of simulations. The latter approach, which may be said to consist of developing a model system or process and then operating the model to observe performance, can avoid most of the major deficiencies of the other two. A simulation system known as PRODYC has been developed for aiding in the analysis and design of chemical process control systems. It is capable of simulating the dynamics of an entire plant including the control function. The system has subroutines for handling mixers, dividers, continuous stirred tank reactors, valves (with controller), transmission delay, and simple distillation. The structure of the PRODYC system, the input requirements, and the expected results are clearly defined. Techniques for expanding the system are explained.

* * *

APPLICATIONS OF IDENTIFICATION AND CONTROL METHODS

Louisiana State University, Department of Chemical Engineering. James H. Dube. May 1971. 224 pages.

AD–725 052

With the coming of high-speed, accurate, and flexible digital computers the chemical industry has been turning to direct digital control (DDC) of production facilities in order to gain economic advantage. In spite of the superiority of digital methods over conventional analog methods in many applications, it is doubtful that DDC will completely replace analog controllers. Therefore, work was undertaken in an effort to improve tuning procedures for analog controllers, and to apply multiple linear regression identification to obtain linear discrete models suited to controller synthesis and adaptation. Efforts were made to develop control methods which are meaningful in industrial applications. Work was also undertaken to show that, with respect to DDC, relatively simple modeling and controller design techniques can be implemented without sacrificing performance. It is hoped that demonstrations of effective but uncomplicated control schemes will encourage expanded application of DDC to the chemical industry.

* * *

Process Engineering

ELECTROCHEMICAL RECOVERY OF HIGH-PURITY NICKEL AND COBALT FROM CRUDE NICKEL AND FERRONICKEL

Bureau of Mines. P. T. Brooks, and G. M. Potter. June 1970. 30 pages.

PB–192 297

Nickel and cobalt used by industry are mainly high-purity metals derived by electrolytic refining of crude nickel metal to remove deleterious impurities. In nickel refining, cobalt and iron, because of their similarity to nickel, ordinarily are separated from nickel by difficult and costly operations. The report describes the results of a pilot-scale investigation that demonstrates new modifications to the electrolytic refining process in which cobalt and iron are removed by simpler operations. Furthermore, higher purity nickel can be produced. The new process comprises application of solvent extraction techniques to remove the cobalt and iron and the electrodeposition in diaphragm cells of pure nickel and cobalt from chloride-based purified electrolyte.

◆

PYRITE DEPRESSION BY REDUCTION OF SOLUTION OXIDATION POTENTIAL

Utah University, Department of Mineral Engineering. December 1970. 63 pages.

PB–200 257

Almost all sulfide ores are processed by the froth flotation technique, and in doing so the rejection or depression of pyrite, a common sulfide mineral, to the worthless gangue or tailing product is frequently required to make an effective separation. Industrially this is most readily accomplished with xanthates as collector of the valuable sulfides, and cyanide salts as a depressant. It has now been found that, with potassium ethylxanthate as a collector, pyrite may be effectively depressed in both lead and copper sulfide ores without the use of the highly poisonous cyanide salts. More specifically, the use of sodium sulfite as the depressant may result in metallurgical, economical, environmental, and safety advantages over the cyanide method.

◆

DIFFERENTIAL EXTRACTION OF RARE-EARTH ELEMENTS IN QUATERNARY AMMONIUM COMPOUND-CHELATING AGENT SYSTEMS

United States Department of the Interior, Bureau of Mines. D. J. Bauer, and R. E. Lindstrom. June 1971. 16 pages.

PB–200 705

Solvent extraction is an important laboratory and industrial technique for recovering, separating, and purifying rare-earth mixtures. The usefulness of this method has now been extended by the finding that a commercially available quaternary ammonium compound system can effectively separate light-group rare-earth mixtures. The process is particularly useful for obtaining pure lanthanum and neodymium fractions.

◆

DISTILLATION DIGEST. VOLUMES 1 AND 2

John I. Thompson and Company. March 1970. 340 pages.

PB–201 022

The document is comprised of 37 articles covering many phases of desalination by the distillation process. Topics include: Flashing in multi-stage evaporators; demisters for desalination plants;

condenser tube life; tubing fabrication methods; protective coatings; a 16-stage high-temperature flash pilot plant; vertical tube evaporator plant; an aluminum pilot plant; skid-mounted flash distillation plant; recent heat-transfer data; properties of concrete at elevated temperatures; a gas-turbine-powered vapor compression plant for evaporation of seawater; multiphase ejectors; control of alkaline scale; aluminum heat transfer surfaces; tests on concrete and accessory construction materials; solar distillation research; tube bundle flow; fluidized bed heat exchangers; system and cost effectiveness for large plants; removal of calcium and dissolved oxygen from sea water.

* * *

Waste Processing

✓

THE CONSTRUCTION OF A CHEMICAL-MICROBIAL PILOT PLANT FOR THE PRODUCTION OF SINGLE CELL PROTEIN FROM CELLULOSIC WASTES

Louisiana State University, Division of Engineering Research. C. E. Dunlap. 1970. 143 pages.

N70–42445

Cellulose is by far the most widespread and readily available of all solid organic materials. Vast quantities of this material accumulate as waste products from such activities as food processing, lumbering, paper making, cereal grain harvesting, and sugar cane processing. Additionally, municipal and industrial wastes of cellulose as paper amount to astronomical proportions. The report discusses a process which can turn cellulose into a powder having a crude protein content of 50 to 60% to be used as a possible food supplement. This process produces microbial single cell protein from waste sugar cane bagasse. The bagasse is ground and mixed with simple nutrient salts to form the fermenter feed. Using Cellulomona bacteria, the maximum volumetric production efficiency was about 0.10 grams dry cell mass per liter of fermenter capacity per hour. The costs and pilot plant design are discussed.

* * *

STATE-OF-THE-ART REVIEW ON PRODUCT RECOVERY

Resource Engineering Associates. November 1969. 113 pages.

PB–192 634

Product recovery from waste waters is an accepted practice from an economical and pollution control point of view. The recovery, reuse and sale of materials from liquid effluents, and those produced as a result of the treatment of liquid effluents is reviewed. Some of the major water use industries reviewed include: pulp and paper mills, steel industry, metal plating, mining, coal by-products, petroleum industries, sludge disposal, heat recovery, food industries, fertilizer industry, animal products, textile industry, chemical industry. The economical, technical, and philosophical framework which determines the application of product recovery is presented wherever possible. The principal areas of discussion are waste reduction practices, in-plant control, recovery techniques and practices, and operating problems.

* * *

RECOVERY OF METALS FROM ELECTROPLATING WASTES BY THE WASTE-PLUS-WASTE METHOD

Bureau of Mines. L. C. George, and Andrew A. Cochran. August 1970. 13 pages.

PB–194 948

Significant tonnages of valuable metals and chemicals can be recovered from industrial plating wastes, which are richer in metal content than many ores presently being processed. A process is described in which an acid waste was added to an alkaline cyanide waste for five different combinations of electroplating wastes containing silver, cobalt, copper, chromium, iron, or nickel. At the optimum final pH values of the mixtures, metals and cyanides were almost quantitatively precipitated.

* * *

TREATMENT OF SOLE LEATHER VEGETABLE TANNERY WASTES

Cincinnati University. J. David Fye. September 1970. 120 pages.

PB–199 068

The tanning industry long has been recognized as a major contributor to water pollution because of the high concentrations of organic and inorganic substances present in untreated tannery effluents. In recognition of the need for finding acceptable means of waste treatment which might be employed throughout the industry, a study was undertaken to find a technically feasible and economical procedure for treating the wastes from a sole leather vegetable tannery. The treatment scheme consisted of separation and pretreatment of the individual waste streams followed by mixing all waste streams for additional treatment in an anerobic-aerobic lagoon system. The system was designed to treat one million gallons of waste per week. The biological oxygen demand was reduced 85–95% and the suspended solids reduction was in excess of 95%. It is estimated that the operating cost is 7 cents per hide processed.

* * *

NEW TECHNOLOGY FOR TREATMENT OF WASTEWATER BY REVERSE OSMOSIS

Envirogenics Company. September 1970. 77 pages.

PB–199 362

The use of the reverse osmosis technique for municipal wastewater renovation has been hampered by the fact that available membranes could not maintain sufficiently high fluxes over acceptably long periods. Flat-sheet membranes with greatly improved fluxes and excellent flux stability have now been fabricated from cellulose esters. At the same time, rejection of organic and ionic constituants adequate for renovation of municipal wastewater by reverse osmosis was achieved. Certain of the new membranes exhibited osmotic performance suitable for low-pressure reverse osmosis operation, which may offer economic advantages over high-pressure operation.

* * *

NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES (1ST), PROCEEDINGS, HELD AT PORTLAND, OREGON ON 6–8 APRIL 1970

Federal Water Quality Administration. April 1970. 400 pages.

PB–199 709

The document is comprised of the papers presented at the first of a planned series of conferences devoted to current research on treatment of food processing wastes. Topics include: Aerobic secondary treatment of potato processing wastes; use of fungi imperfecti in waste control; aerobic treatment of liquid fruit processing waste; treatment and reuse of plant effluent in the citrus processing industry; seafoods processing pollution problems; concentration of sugarbeet wastes for economic treatment; reuse of olive processing brines; in-field processing of tomatoes; dry caustic peeling of vegetables and fruits; animal feeds from vegetable wastes; rice hull utilization.

* * *

REUSE OF CHEMICAL FIBER PLANT WASTEWATER AND COOLING WATER BLOWDOWN

Fiber Industries, Incorporated. October 1970. 70 pages.

PB–200 695

Demonstration studies were conducted to determine the feasibility of reusing industrial and domestic wastewaters from a polyester fiber manufacturing plant. The wastewaters consisted of organic chemical processing wastes, cooling system blowdown, and domestic wastewaters from the plant. The results indicate that 0.33 mgd wastewaters can be treated and reused at a rate of 0.10 mgd for approximately $0.40/1000 gallons.

* * *

MATERIALS

EVALUATION OF THE FUSION CASTING PROCESS FOR CERAMIC MATERIALS

Rutgers University. William H. Bauer, Richard G. LaBar, Robert W. Matolka, and Joseph E. Palko. September 1969. 137 pages.

AD–700 392

The fusion casting of ceramic refractory shapes consists of pouring a molten mass of batch into a suitable mold from an electric arc furnace. The document reviews literature on the subject, presents mechanical, thermodynamic, microstructural, and physicochemical considerations, and discusses nucleation and solidification principles, observing that the method is useful for obtaining microstructures which cannot be developed by other techniques. Experiments using graphite molds are noted, and the concept of induced nucleation involving crystalline microstructures is evaluated. Several furnace designs are described, melting operations are outlined, and voltage and temperature requirements are discussed. Pouring procedures are given. The instrumentation for all sequences is included.

* * *

A LITERATURE SURVEY ON PHYSICOCHEMICAL PROPERTIES OF GLASS AND THEIR INTERACTION WITH VAPORS

Iowa State University, Engineering Research Institute. Rodney J. Huang, Richard D. Johnson, Turgut Demirel, and Thomas McGee. February 1970. 115 pages.

AD–708 709

The report presents an annotated bibliography on the surface properties of glasses and adsorbates dealing with subjects ranging from surface wetting to the degradation of glass reinforced plastics. Most of the major research fields dealing with glasses or glass fibers have been included. The majority of the reports, however, are concerned with glass surfaces in composite materials. The literature was searched from 1949 through part of 1969. An author index and list of periodicals searched are included.

* * *

WELDING OF CERAMICS

Naval Research Laboratory. Roy W. Rice. July 1970. 38 pages.

AD–710 359

The welding of ceramics is a relatively new technology, involving the joining of refractory materials subject to cracking. The document outlines, for example, the advantages of solid state and fusion welding over mechanical fastening, adhesive bonding, and brazing. Requirements and problems are discussed, including thermal stress effects and crack propagation, as well as chemical compatibility in welding oxides, graphite, carbines, and nitrides. The electron beam welding of aluminum oxide is noted in particular. A review is given of all known work on refractory ceramics welding, with a summarization of the data.

* * *

CHEMICAL STRENGTHENING OF CERAMIC MATERIALS

Ceramic Finishing Company. Henry P. Kirchner, W. R. Buessem, Robert M. Gruver, Dennis R. Platts, and Ralph E. Walker. December 1970. 166 pages.

AD–717 983

In polycrystalline ceramics subjected to external forces, fracture originates at surface flaws. Compressive surface layers prevent surface flaws from acting to cause failure. Therefore, these compressive surface layers can be used to obtain improved ceramic strengths. The report discusses the investigation of treatments applied to alumina, zirconium diboride, silicon carbide, and zircon porcelain bodies. The treatment methods included quenching, glazing and quenching, formation of low expansion surface layers by reaction with powders at high temperatures, and chemical vapor deposition of low expansion surface layers. Substantial improvements in room temperature flexural strength were observed. In some cases improved elevated temperature flexural strength and room temperature impact resistance were demonstrated.

* * *

DYNAMIC AND THERMAL ASPECTS OF CERAMIC PROCESSING

University of Rhode Island. Peter J. Gielisse, and Joseph Stanislao, November 1970. 69 pages.

AD–728 011

A major feature in the manufacture or fabrication of ceramic products is detailed knowledge of the variables and their interrelations in the processing and finishing cycles. For this reason, a dynamic and thermal evaluation was made of several aspects of ceramic stock removal. Significant insight into heat distribution and temperatures generated at the diamond-ceramic interface during single point grinding was gained. Heat transfer models were developed which allow for the calculation of heat distribution into the major components of the grinding system, and for the calculation of the interfacial diamond-workpiece temperature from direct or indirect measurements. Also, force analysis on a variety of aluminas under various grinding conditions have indicated the average force level for aluminas.

* * *

EVALUATION OF THE FUSION CASTING PROCESS FOR CERAMIC MATERIALS

Rutgers University. William H. Bauer, Richard G. LaBar, Robert W. Matolka, and David Reid. March 1968. 162 pages.

AD–842 454

A study of fusion casting (an electric furnace method of pouring, solidification, and annealing of refractory metal oxides) has been made in line with recent increase of interest in this field. The document discusses some advantages of the process, particularly the production of high density structures and the use of the material as its own container. Reference is made to some of the problems encountered as well as precautions to be taken. Investigation is reported on a program chiefly devoted to improving the structural soundness of high alumina compositions, with attention to the refinement of crystal size and to the development of microstructures not attainable by other means. The brittle behavior of ceramic materials is considered, along with difficulties attendant to their processing which are not met with in metals or glass. Evaluation is described using microscopic methods, mechanical damping measurements, and strength testing. A torsional technique for observing microcreep is also described.

◆

METHODS FOR PRODUCING ALUMINA FROM CLAY. AN EVALUATION OF TWO LIME SINTER PROCESSES

Bureau of Mines. John J. Henn, Paul W. Johnson, Earle B. Amey, III, and Frank A. Peters. September 1969. 47 pages.

PB–187 668

The development of a commercial process for extracting alumina from low grade materials is a challenging technological problem that has not been solved satisfactorily. The report evaluates the relative merits of two lime sinter processes for recovering alumina from clay. In the processes, clay and limestone are mixed and sintered to form calcium aluminate from which alumina is extracted as sodium aluminate by leaching with a solution of sodium carbonate. The costs of the processes are discussed.

◆

PROCEEDINGS OF THE SYMPOSIUM ON REDUCTION OF COSTS IN HAND-OPERATED GLASS PLANTS. PRESENTED BY WEST VIRGINIA UNIVERSITY, CLARKSBURG, 1970

West Virginia University. Raymond E. Shafer. 1970. 79 pages.

PB-196 138

The symposium was concerned with the future of the hand glass industry, and especially with improving efficiency with reduction of costs. Considerable attention was paid to the use of new fuels such as a propane-air mixture to supplement or replace possibly declining supplies of natural gas in the production of glazes or in fire polishing. Control of fuel costs was related to up-dating equipment such as melters, lehrs, glazers, and glory holes, and considerable analysis was directed to those elements. Temperature control and measurement was underlined, along with discussions of heat transfer properties and melting properties. Monitoring the combustion processes was recommended.

◆

A NEW VACUUM GLASS-FORMING MACHINE

Sandia Laboratories. K. D. Boultinghouse. September 1969. 20 pages.

SCDR–69–331

Need for glass tubing with particularly high precision in inside dimensions has led to the development of a vacuum process forming machine. The document describes the components and operations of an assembly which was evolved to obtain low-cost precision glass cases for Sandia Laboratory rolamite cases but which appears to have applications in other fields. An inconel or stainless steel mandrel, depending on the inside diameter required, is inserted into glass tubing—which may be as long as 36 inches—for vertical mounting through a traveling oven in a vacuum environment. The inner tube shape may be either cylindrical or tapered.

◆

Coating

EFFECTS OF METALLIC COATINGS AND ZINC RICH PRIMERS ON THE PERFORMANCE OF FINISHING SYSTEMS FOR AUTOMOTIVE STEEL

Army Coating and Chemical Laboratory. Melvin H. Sandler. September 1970. 39 pages.

AD-712 997

In recent years the automotive industry has increased the usage of galvanized steel and zinc-rich primers on underbody components. In view of the increased corrosion resistance obtained, a program was conducted to determine the effect of metallic coated steels and zinc-rich primers on automotive body steels exposed to severe climatic conditions. The data demonstrated that, of the various systems tested, hot dip galvanized steel properly finished offers an effective corrosion resistant system in environments such as sea coast salt atmospheres and hot tropical weather.

◆

DEVELOPMENT OF IMPROVED INHIBITIVE PRIMERS

ITT Research Institute. K. S. Rajan. December 1970. 98 pages.

AD-720 384

The primary cause of failure of paint films on aluminum in marine atmosphere is the spread of corrosion under the paint film from the side of a defect on the film. Conventional chromate-based primers only prevent the spread of corrosion, and it is left to the natural protective processes for repairing the corrosion at defect areas. It has been found that alizarin, a lake-forming anthraquinone dye, can provide satisfactory corrosion prevention. The report presents research concerning the elucidation of the molecular mechanism of the inhibitory function of alizarin and the exploration of a number of organic inhibitors belonging to the classes of hydroxyanthraquinones, lake-forming diazo compounds, phthaleins, triphenylmethanes, and phthalocyanines. Stress corrosion studies on titanium using the different promising inhibitor systems above are also described.

* * *

PROTECTIVE TREATMENTS (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. March 1971. 92 pages.

AD-722 800

Summaries are provided for U.S. Government funded reports, covering the period 1953-1971, dealing with compositions and methodologies for the production and effective use of three types of coatings: Anodic, as for corrosion or abrasion protection, metal substitutions to reduce weight or costs, and improvement of optical characteristics; antifouling, including plastic and chemical paints, creosoting, and marine biological toxicants; and diffusion, in vacuum procedures for transistors, for fabrication of alloy or refractory metal coverings, for oxidation prevention or chemical strengthening, and similar objectives. The reports listed are available from NTIS.

* * *

Composite Materials

MANUFACTURING METHODS OF COMPOSITE MATERIALS

Defense Documentation Center. February 1970. 66 pages.

AD-701 500

Summaries are given of U.S. Government funded reports, covering the period 1963-1969, dealing with the manufacture of composite materials for military and industrial applications; aerospace, automotive, and machine tool engineering; high-temperature, electronic, electrical, metallurgical, and ceramic equipment; and allied topics. State-of-the-art reviews, along with discussions, are included on materials, properties, methodologies, and structures. The reports listed are available from NTIS.

* * *

FUNDAMENTAL CONCEPTS OF COMPOSITE MATERIALS

Boeing Scientific Research Laboratories. R. L. McCullough. April 1970. 117 pages.

AD-705 639

The structures of modern engineering frequently make mechanical demands which cannot be met by a single material; in such cases a search is made for composites which can fill the need. Thus inorganic and organic substances are combined, matrices, laminates, and binders are developed, and coatings, resins, and other exploratory products are investigated. For comprehension of the field of composites, the basic concepts must first be understood. The document is intended to supply information on the concepts of composite materials, summarizing a large quantity of data, presenting illustrative figures, and reviewing mathematical models for the principles discussed. Several composite structures are analyzed, such as floors and helicopter rotor blades. A survey is given of theory, mechanical property prediction, and such mechanical properties as compressive strength and tensile strength. Other discussions cover interphase regions, resin properties, and the possible influence of surfaces on polymer structure.

* * *

MINIMUM WEIGHT STRUCTURAL SANDWICH

Forest Products Laboratory. Edward W. Kuenzi. November 1970. 17 pages.

AD-715 989

Wooden panel construction is considered with relation to a concept of thin strong facings on lightweight thick cores. The report discusses theoretical determinations of sandwich structures, noting that minimum weight construction may not be mechanically practical in some conditions or may be impractical as arrived at by pure theory. It presents some general analyses of a minimum weight sandwich, considering stiffness, edge load capacity, and bending moment capacity. Mathematical derivations are given, along with a discussion of the limitations and the availabilities of materials.

* * *

PLASTICS IN COMPOSITE MATERIALS

Defense Documentation Center. April 1971. 233 pages.

AD-722 940

The document presents summaries of U.S. Government funded research reports on plastic components for composite materials. Some of the materials covered are laminates, epoxies, phenolics, and halocarbons. Stress, tensile, and failure characteristics exhibited in tests are reported. The subject matter includes glass reinforcement and the use of fiberglass, nylon, carbon fibers, amines, elastomers, graphite, silicon coatings, and boranes. Data is included on the mechanical characteristics imparted by bonding, sandwich construction, and honeycomb cores.

* * *

CONCRETE-POLYMER MATERIALS

Brookhaven National Laboratory, and Bureau of Reclamation. M. Steinberg, and J. T. Dikeou. December 1969. 73 pages.

BNL-50218

Remarkable improvements in the structural and durability properties of concrete can be obtained by monomer impregnation and in situ polymerization either by radiation or thermal catalytic means. The report concerns efforts to investigate and develop such composite materials as building materials. Information is provided on monomer selection and concrete-polymer preparation. Extensive data are given on durability properties (e.g., freeze-thaw durability, acid and sulfate resistance) and long-term mechanical properties (e.g., creep). The results of measurements of mechanical properties of various compositions at elevated temperatures (up to 143C) are included. Consideration is given to the employment of concrete-polymer materials in such applications as pipes, house components, and underwater structures.

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INVESTIGATION OF ADDITIVES FOR IMPROVEMENT OF ADHESIVE AND ELASTOMER PERFORMANCE

Tracor Incorporated. Patrick E. Cassidy, James M. Johnson, and Gary C. Rolls. July 1970. 167 pages.

N70-41998

Coupling agents are used to form the primary chemical bond linkage between a nonorganic substrate and an organic adhesive system. This report contains the results of an investigation undertaken to provide a basic understanding of the behavior of coupling agents and to provide practical data over a wide range of temperature. A survey of the literature on the subject published over a 20 year period provides the basis of a comprehensive review which is included in the report. The review gives a background of various adhesion theories, discusses in detail the principal classes of coupling agents, and includes tables of commercial coupling agents and some of their properties. The report also presents the results of an experimental evaluation of 19 coupling agents used as additives in urethane and epoxy adhesives and in a filled urethane elastomer.

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CARBON COMPOSITE MATERIALS

Union Carbide Corporation. L. M. McLaughlin. September 1969. 314 pages.

Y-DA-2654

A state-of-the-art review is given on carbon-based composite materials as part of a program to develop materials for thermal insulation. The data cover preparation, forming, and machining technology; mechanical analyses of carbon structures; investigations of physico-thermal characteristics exhibited by graphites, foams, and structural forms such as honeycomb; and studies of chemical structures and morphology. The characteristics of commercially available insulating materials are described. Many illustrations and tables of data are included.

Construction Materials

THE EFFECT OF TEMPERATURE ON CREEP OF CONCRETE: A LITERATURE REVIEW

Army Engineers Waterways Experiment Station. Helmut G. Geymayer. January 1970. 35 pages.

AD-699 825

The document presents a review of literature on time dependent volume changes in concrete as affected by loading, stress, materials maturity, and moisture content. An analysis is made of the available data in light of several theories of the mechanisms of concrete creep. It is noted that the results of current tests conducted above 100 deg C. do not agree, and a test program for three stress/strength ratios in a wide temperature range is proposed.

REJUVENATION OF ASPHALT PAVEMENTS

Materials Research and Development, Incorporated. F. S. Rostler, and R. M. White. December 1970. 69 pages.

AD-878 900

The document is concerned with the causes and nature of asphalt pavement deterioration, and presents a discussion of asphalt rejuvenators. Among the topics covered are the chemical and mechanical properties of paving bitumens, theoretical and practical considerations, manufacturing methods, reversibility of the aging process, restoration by additives, and specification criteria far rejuvenation. Data on five commercially available rejuvenators are given, and flow charts and graphs depicting the processes are included.

MATERIAL QUANTITIES FOR SEAL COATS AND SURFACE TREATMENTS

Illinois University. Charles R. Marek, and Moreland Herrin. June 1970. 222 pages.

PB-199 173

A fundamental concept in the design of highway pavements is that the quantity of bitumen needed in the surfacing is determined by the voids or interparticle spaces in the aggregates. The document describes instrumentation and methodology for determining the amount of void or interparticle spaces in the aggregates, and discusses the influence of differences in void exhibited by various materials. The size and shape of aggregate particles, such as gravel or crushed stone, is related to the percent void volume; and the percent void volume is related to depth of the aggregate layer and to particle orientation. The effect of one-size vs multiple-size aggregates is considered, along with the influence of fine materials present. Tests are described on spread per unit area. The effect of embedment of aggregates is discussed, and a report is made on simulation of compaction and finished surfaces. Data treatment methodology is noted.

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THE CONFERENCE ON FRONTIERS IN RESEARCH AND PRACTICE IN PLAIN CONCRETE

Illinois University. Dan J. Naus. December 1970. 44 pages.

PB-199 209

The document is comprised of the following papers from the conference: The engineering challenge to concrete; Recent developments in understanding the matrix of concrete; The mechanics of concrete as a multiphase material; Effect of extreme environment on concrete; Moisture migration in concrete; Recent developments in cements.

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CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS

Brookhaven National Laboratory, and Fairbank Highway Research Station. M. Steinberg, L. E. Kukacka, and R. G. Pike. September 1970. 85 pages.

PB-199 376

Significant improvements have been obtained in the structural and durability properties of both high and low quality concretes by impregnating the concrete with a monomer and then polymerizing it by either radiation or thermal catalytic means. For example, a light-weight structural concrete-polymer using methyl methacrylate as the impregnant exhibited a three-fold increase in compressive and tensile splitting strengths, together with a reduction in creep of greater than 1/10. Impregnated thermal insulating 1/6 perlite concrete was found to have a 20-fold increase in compressive and tensile splitting strengths as compared to non-impregnated types. Preliminary design studies indicate that concrete-polymer materials have value for precast bridge decks, breakaway lampposts, and other highway applications.

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EVALUATION OF EPOXY COMPOUNDS AS A MATERIAL FOR PATCHING AND PROTECTING CONCRETE

Virginia Highway Research Council. Wallace T. McKeel, Jr. March 1971. 43 pages.

PB-199 792

Epoxy resin systems, widely used in the maintenance of highway bridges, have been assessed as highly successful to totally disastrous, occasioning serious research. Such factors as application techniques and resin properties must be better understood in relation to concrete repair and bridge deck sealing. A double test program was initiated to investigate the wear characteristics of seven epoxy resin systems on two Virginia bridges, one connected with skid resistance and concrete protection, the other in regard to patching effectiveness. Thin bonded overlays containing deslicking aggregates were applied as seal coats and as shallow surface repairs. The results indicate that regardless of the type of deslicking aggregated employed, unprotected epoxy overlays suffer a continuing decline in skid resistance under exposure to traffic, and that the use of an asphaltic wearing course is needed to protect the epoxy sealcoat.

Corrosion

A SURVEY OF PUBLICATIONS DEALING WITH CORROSION IN WIRE ROPE

Catholic University of America, Institute of Ocean Science and Engineering. Herbert T. Wood. January 1971. 28 pages.

AD-725 134

Wire rope, an important item in such fields as undersea engineering and the mining industry, is a complex hardware product in which cold drawn wires are wound together in strands and the strands are then wound together to form the wire rope. The basic wires may be composed of such metals as steel, monel, nickel base alloys, stainless steel or phosphor bronze, and may be coated with an alloy, a metal, or a plastic compound to combat corrosion. The document is especially concerned with sea operations; it discusses salt water properties, mechanical effects of flexing, and the electrochemical actions involved in corrosion and corrosion protection. Report data is presented from an extensive literature search on the types of corrosion, cathodic protection, coatings, and lubricants. An annotated bibliography is included.

Fibers and Textiles

A FUNDAMENTAL RESEARCH STUDY OF THE CONVERSION OF POLYMERS TO FIBERS

North Carolina State University, School of Textiles. Robert W. Work, and John A. Cuculo. November 1969. 331 pages.

AD-700 404

The main body of the report is comprised of a rather extensive bibliography, covering the years 1940-1966, of the English language literature on various aspects of dry spinning and synthetic fiber formation. Each entry is accomplished by an annotated abstract with brief summary comments. Also included in the report are the results of an original research project on the engineering principles which are involved in the conversion of bulk, linear, fiber-forming polymers into usable fibers.

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DEVELOPMENT OF FIRE-RESISTANT AND RAIN-PROTECTIVE FABRIC

Prodesco. Incorporated. Robert Donnelly. December 1968. 50 pages.

AD-849 491

The document reports on a 15-month search for a lightweight air-permeable material, needed for use in a high rainfall environment, which can combine fire resistance with laundering endurance and colorfastness to light. Specifications for a desired end product are listed. Fourteen filament fabrics chosen for the research are identified and discussed, and the various testing methods are described. The data obtained in a three-phase investigation appear in chronological order. The first phase compared yarn blending techniques, studied fabric design and production, and outlined the physical testing of the samples. The second phase involved refining and processing details for the various materials. The third phase comprised the weaving and finishing of a Nomex material which was selected for commercial production.

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Lubricants and Hydraulic Fluids

SELECTION OF POSSIBLE LUBRICANT ADDITIVES FOR HYDRAULIC FLUIDS

Army Weapons Command, Research and Engineering Directorate. Carol J. Schroeder. February 1970. 42 pages.

AD-703 864

In recent years, an increased demand has arisen for hydraulic fluids capable of decreasing wear or providing longer wear life, and possessing better antigall and antisieze characteristics. In response to this demand, an examination was made of the lubrication characteristics of possible lubricant additives and non-lubricant additives in an effort to determine which additives or additive combinations might be feasible as lubrication improvers for hydraulic fluids. Several very promising combinations were identified.

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Metals and Alloys

LITERATURE SURVEY ON THE INFLUENCE OF ALLOYING ELEMENTS ON THE FRACTURE TOUGHNESS OF HIGH ALLOY STEELS

TRW Incorporated. C. Vishnevsky. February 1970. 82 pages.

AD-701 908

The document presents a review of the literature on the effects of various alloying elements such as nickel, cobalt, aluminum, copper, titanium, niobium, molybdenum, tungsten, and chromium on the toughness of steels intended for use in high strength structures. Topics covered include impurities and interstitials, elements which stabilize austenite, carbide formers, secondary hardening and microstructure. Much of the data appears in graphic form. Melting practices and embrittlement phenomena are discussed, along with microstructural control by thermal or thermomechanical processing.

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SOLIDIFICATION AND THERMO-MECHANICAL PROCESSING OF ALUMINUM INGOTS

Massachusetts Institute of Technology. M. C. Flemings, A. J. Campagna, R. Mehrabian, A. Reti, and S. N. Singh. October 1969. 128 pages.

AD-705 666

The document is concerned with research on the effects of thermomechanical processing on the properties of wrought high-strength aluminum alloys. Attention is paid to the effects of solidification variables upon the structural qualities of cast aluminum. A report is made on the investigation of solution treatment and heat flow in unidirectional solidification for 4.5% copper alloy, along with fracture behavior. Much of the data appears in graphic form accompanied by fractographic photographs. Laboratory simulation is described of a type of macrosegregational or divided flow occurring in the cooling process, designated as a negative cone of segregation in interdendritic flow.

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A REVIEW OF THE INFLUENCE OF NONMETALLIC INCLUSIONS ON THE MECHANICAL PROPERTIES OF STEEL

Watervliet Arsenal. Peter Thornton. May 1970. 75 pages.

AD-707 401

The document is concerned with impurities in steel which are considered as generally detrimental to steel performance. A review is given on the effects of oxides, sulfides, nitrides, and other nonmetallic compounds which, when present in quantities in excess of their solubilities in the metal separate to form inclusions, affecting stresses, tensile and impact strength, fatigue properties, and fracture toughness. Reduction of area producing holes is covered, along with crack propagation. The effects of inclusions are related to the mechanical properties of steel by their shape, size, quantity, interspacing, distribution, orientation, and physical properties differing from the matrix.

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SOME EFFECTS OF HYDROSTATIC PRESSURE IN METALS AND ALLOY AND ITS USE IN METAL FORMING PROCESSES

Maryland University. P. J. Worthington. December 1970. 33 pages.

AD-722 416

An expanding interest in deep ocean engineering has generated research on the effects of a deep sea environment on materials used there, and the effects of high pressure on materials in general. The document is concerned with the characteristics of metals under hydrostatic pressure, including the results of tests conducted after a pressurized environment has been removed—the pressure soaking technique, and while pressurization is maintained. Experimental equipment, including a closed cylindrical chamber containing test specimens in a highly compressible fluid, is described. The advantages and costs of pressurized tests are outlined and related to commercial applications such as wire production, noting the favorable factors of reduced costs, less attrition to dies, and forming of materials impossible to form by conventional methods. Data on the behavior of metals and alloys, stress on particle shapes, and crystallographic relationships are given. Much of the information appears in graphic form.

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DESIGN, INDUSTRIAL PRODUCTION, AND EVALUATION OF IMPROVED DUCTILE CAST IRON ALLOYS USING COMPUTER DERIVED MATHEMATICAL MODELS

Northeastern University. John Zotos. January 1971. 47 pages.

AD-722 881

Some of the mechanical properties of cast iron continue to be a problem, and means of improving them are continually sought. An investigation is reported in which various elements were added in order to produce a ductile cast iron alloy. These included boron, silicon, manganese, aluminum, copper, sulfur, magnesium, molybdenum, titanium, and tin. Mathematical models were derived from experimental and statistical data, computer analysis being utilized to formulate the equations required. The results are believed to be statistically and metallurgically significant for the production of ductile cast iron shells having predictable properties. Some variables evaluated were section size, grain, thermal properties and alloy proportions. Data from several contributing industrial plants are given, appearing in graphic form.

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EUTECTIC ALLOYS—A DDC BIBLIOGRAPHY

Defense Documentation Centers. June 1971. 155 pages

AD-725 710

Alloys of eutectic composition, and especially the recently developed directionally crystallized eutectic alloys, have found application in many areas of technology. This indexed bibliography provides summaries of over 100 research reports dealing with these alloys. Information concerning casting, milling, cutting, processing, and mechanical properties is included. All of the reports referred to in the bibliography are available from NTIS.

DESCRIPTION AND ENGINEERING CHARACTERISTICS OF ELEVEN NEW HIGH-TEMPERATURE ALLOYS

Battelle Memorial Institute. Ward F. Simmons. June 1971. 42 pages.

AD-726 618

The document contains a description and summary of preliminary properties of several new alloys which are considered to be promising high-temperature materials. Most of the alloy-development activity in recent years has been in the nickel-base system. The aim has been to improve hot-corrosion resistance while maintaining a good combination of mechanical and physical properties. The alloys included are the iron-base alloys Alloy 326 and AFC-260; the iron-nickel-base alloy Pyromet 860; and nickel-base alloys Udimet 710, IN-738, MAR-M 421, MAR-M 432, TRW-NASA VI A, Unitemp AF 2-IDA; the cobalt-base alloy Haynes Alloy No. 188; and the nickel-cobalt-base alloy Multiphase MP-35N.

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INVESTIGATION INCLUDING A TESTING PROGRAM TO STUDY AND DEVELOP METHODS FOR IMPROVING DUCTILITY OF BERYLLIUM

Franklin Institute Research Laboratories. James E. Hanafee. February 1971. 36 pages.

AD-727 747

Beryllium, the only stable lightweight metal with a relatively high melting point, has found increasing use in various engineering applications, but rolling it into sheets has presented problems. The document describes a new process by which high purity beryllium ingot is formed into sheets of fine grain size resulting in plastics bend ductility considerably better than anything obtained heretofore. The process consists of encasing the ingot section in a nickel sheath, rolling at the desired temperature, and finally dissolving the sheath in warm nitric acide, no annealing being required. Recovery and recrystallization characteristics, microstructural and mechanical properties, and energy storing are discussed. Feasibility is noted for producing a fine grain high purity ingot beryllium sheet.

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AN EVALUATION OF VARIABLES IN BASIC OXYGEN STEELMAKING

Bureau of Mines. V. R. Spironello, H. A. Tucker, and W. C. Hill. February 1970. 41 pages.

PB-190 773

Recent research has been concerned with increasing the efficiency of processing steel scrap in addition to conventional steel materials. A test program is reported in which pig iron, auto scrap, clean steel rods, and deck plates were melted in a basic oxygen furnace, limestone, lime, and fluorspar added in accordance with particular procedures, and attacked with oxygen at various experimental conditions. Data from seven variables, including furnance rotation rate, number of oxygen jets, angle of oxygen injection, scrap temperature, lime reactivity, and rate of oxygen flow, and for thirteen responses appear in tabular form.

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INFLUENCE OF ROLLING TEMPERATURE AND COPPER CONTENT ON CREEP AND OTHER PROPERTIES OF ZINC-COPPER AND ZINC-TITANIUM-COPPER ALLOYS

Bureau of Mines. Leander A. Neumeier, and J. S. Risbeck. April 1970. 50 pages.

PB-190 971

The creep resistance of Zn alloys is known to be greatly improved by the addition of minor alloying elements such as Cu and Ti. Such alloys, however, are very sensitive to various combinations of composition, rolling temperature, reduction, and other process variables. It is felt that a clearer understanding of these factors can serve more efficient and consistent processing and aid in the development of improved alloys which could be substituted in certain applications for alloys of Cu and Al. Studies undertaken with this in mind have illustrated the role that copper in amounts of up to 1.25% plays in affecting the properties of rolled Zn with and without the addition of Ti. A variety of data relating to microstructure, hardness, tensile properties, thermal expansivity, and creep behavior is presented and discussed. Some of the structural factors thought to have a significant bearing on why the properties vary as they do are discussed in detail.

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EFFECTS OF ROLLING TEMPERATURE AND TITANIUM CONTENT ON CREEP AND OTHER PROPERTIES OF ZINC-TITANIUM AND ZINC-COPPER-TITANIUM ALLOYS

Bureau of Mines. Leander A. Neumeier, and J. S. Risbeck. June 1971. 35 pages.

PB-200 703

The work discussed in PB-190 971 concerning the effects of combinations of composition and rolling variables on Zn alloyed with Cu and Ti was extended to include rolled Zn-Ti and Zn-1.0 Cu-Ti alloys in which the Ti content was varied up to 0.36 weight percent. A variety of data is presented relating to microstructure, hardness, tensile properties, thermal expansivity, and creep behavior. Emperical equations, derived from a statistical analysis, relating creep rates with the major process variables of composition and rolling temperature are presented.

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THE WEATHERABILITY OF POLYOLEFINS

Plastics Technical Evaluation Center. John B. Titus. March 1968. 100 pages.

AD-672 513

A fairly large proportion of the output of the plastics industry goes into products which are subjected to outdoor exposure. Polyolefins are one of the classes of plastics most affected by outdoor weathering. Furthermore, they have the highest volume poundage of all plastics produced. Hence, this review was prepared to aid in the dissemination of available information on the weathering aspects of this plastics family. It covers the effects of the weathering components on polyolefins, exposure testing methods, means of stabilization, and the effects of pigments. In addition, several examples of successful polyolefin outdoor applications are given.

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POLYURETHANE FOAMS: TECHNOLOGY, PROPERTIES AND APPLICATIONS

Plastics Technical Evaluation Center. Arthur H. Landrock. January 1969. 259 pages.

AD-688 132

For many years urethane materials have been increasing in importance for a variety of applications. This report is intended to provide useful information on the state-of-the-art of polyurethane foam technology. The emphasis is on the basic chemistry of urethane foams, methods of manufacture, properties, and applications. Some attention is given to such topics as health hazards, adhesives, coatings, test methods, and costs. A list of all known specifications involving urethane foams or raw materials is included, along with definitions of terms peculiar to urethane foams or foams in general. A bibliography of over 700 references is provided.

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WEATHERABILITY OF POLYSTYRENES AND RELATED COPOLYMERS AND TERPOLYMERS

Plastics Technical Evaluation Center. Joan B. Titus. July 1969. 66 pages.

AD-700 091

About one quarter of the output of plastics goes into products which are subjected to outdoor exposure. The report was undertaken to aid in the distribution of information on the weatherability of polystyrene plastics. Polystyrenes are not weather-resistant materials. After long-term exposure they exhibit yellowing, surface crazing, embrittlement, and loss of strength; however, additives can be used to improve their weatherability. Information is provided concerning exposure and testing methods, means of stabilization (i.e., antioxidants, ultraviolet absorbers), effects of colorants on weather resistance, weathering data, and applications of weather-resistant polystyrenes.

LITERATURE SURVEY ON THERMAL DEGRADATION, THERMAL OXIDATION, AND THERMAL ANALYSIS OF HIGH POLYMERS

Plastics Technical Evaluation Center. Dorothy A. Teetsel, and David W. Levi. November 1969. 196 pages.

AD–706 811

The bibliography is the result of a literature search on thermal degradation, thermal oxidation, and thermal analysis of high polymers. Many of the 1,836 references are annotated. The period searched covered from March 1965 through December 1968. The references are grouped under general and material headings. A subject index and author index are provided.

HIGH-TEMPERATURE STRUCTURAL RESINS

Whittaker Corporation, Narmco Research and Development Division. Paul M. Hergenrother, and Harold M. Levine. June 1968. 79 pages.

AD–713 180

The report summarizes an investigation directed toward the synthesis and evaluation of thermal stable polymers to be used for underwater structural materials. Both polyquinoxaline and polyphenylquinoxaline were tested. Laminates, composites, and fibers were developed for both. Polyquinoxalines were shown to have outstanding processability, adhesive strength, and composite formation using high modulus fibers. Polyphenylquinoxalines are more stable than polyquinoxalines; however, they are more difficult to work with.

TRADE DESIGNATIONS OF PLASTICS AND RELATED MATERIALS (REVISED)

Plastics Technical Evaluation Center. John B. Titus. May 1970. 176 pages.

AD–715 401

A revised alphabetical listing is presented of the trademarks and brand names of a wide range of plastics and allied materials in order to assist various agencies in identifying an item and its manufacturer by means of trade name. The list is restricted to pronounceable words, and omits any designation which is the same as the company name. Identification may be by chemical nomenclature, mechanical composition, use, geometric form or other means.

APPLICATIONS OF IONIZING RADIATIONS IN PLASTICS AND POLYMER TECHNOLOGY

Plastics Technical Evaluation Center. Arthur Readdy, Jr. March 1971. 268 pages.

AD–725 940

Electron bombardment and gamma irradiation are being used increasingly for polymerization and the crosslinking of polymers. Much of this increase is due to the availability of sources for these radiations. The report surveys the uses and potential uses of these high energy ionizing radiations in the processing and modification of polymers. Ionizing radiation has allowed the practical use of materials which could not be polymerized by the normal curing or crosslinking techniques. A few of such materials surveyed include wood-plastic composites, concrete-plastic composites, adhesives, dielectrics, and plastic coatings. There are also discussions concerning the physics and chemistry of many different types of irradiated plastics.

Wood and Paper

PROPERTIES OF IMPORTED TROPICAL WOODS

Forest Products Laboratory. B. Francis Kukachka. March 1970. 69 pages.

AD–704 261

Descriptions of more than 100 tropical genera and generic groups of wood are provided. The report emphasizes properties that affect utilization of the woods, and include botanical names, common names, and principal growth areas. Tables present British and suggested United States kiln drying schedules, total shrinkage from the green to ovendry condition, and strength values for both green and dry conditions.

EFFECT OF FORMING CONDITIONS OF THE WET WEB ON MECHANICAL PROPERTIES OF KRAFT PAPERS

Forest Products Laboratory. D. J. Fahey, and C. W. Polley. March 1970. 14 pages.

AD–704 263

The strength of kraft wrapping paper, bag paper, and paperboard is a most important requirement which may vary considerably according to the method of manufacture as well as the source material. A report is made on the mechanical properties of machine made kraft paper, in comparison to hand processed, as these are affected by stock, consistence, temperature, and weight. Papers of three different sheet weights were made through a range of headbox consistencies, at three different levels of temperature, and for three different levels of stock pH. Wet webs were prepared for the comparative tests, and the finished sheets were evaluated by established test procedures. The resulting data are tabulated according to physical and tensile characteristics, including such properties as density, failure, and tensile behavior.

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NATURAL DECAY RESISTANCE OF 30 PERUVIAN WOODS

Forest Products Laboratory. T. L. Highley, and T. C. Scheffer. July 1970. 6 pages.

AD–709 718

Timber from virgin stands may possess advantages for certain purposes which only such a stand may offer. The document reports on a test program to determine the natural heartwood decay resistance of thirty Peruvian species of timber which occur in virgin stands in quantity and which therefore could become commercially significant. Soil block procedures with white rot and brown rot fungus are discussed, and the test results are tabulated according to weight loss, fungus type, and climatic area.

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WOOD AND LOG CHARACTERISTICS AFFECTING VENEER PRODUCTION

Forest Products Laboratory. John F. Lutz. January 1971. 35 pages.

AD–719 618

A description is given of the physical and mechanical wood properties, and specific characteristics of veneer logs, that are related to veneer production and use. Veneer characteristics that make the wood important for use as construction plywood, faces of decorative panels, core and crossbands of decorative panels, and as containers are noted.

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RAPID PRODUCTION OF PALLET DECKBOARDS FROM LOW-GRADE LOGS

Forest Products Laboratory. R. A. Hann, R. W. Jokerst, R. S. Kurtenacker, C. C. Peters, and J. L. Tschernitz. March 1971. 16 pages.

AD–724 272

Forest product technology is currently being directed toward innovations which may conserve forest resources, reduce timber processing time, and increase cost effectiveness. A process is reported by which low grade logs are turned into industrial commodities with little residue in a time period of minutes instead of days or weeks. Red oak logs are knife cut into sheets on a lathe, the sheets are knife cut into strips for laminae, the laminae are rapid-dried by heated platens under pressure, and bonding

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with accelerated glue cure produces ply boards. The report discusses the usefulness of the method for fabricating reusable pallets for materials handling. Data are presented for average final moisture content and thickness loss vs drying time at given temperature and pressure levels for two thicknesses of laminae. Costs and material savings are noted.

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EVALUATION OF FIRE-RETARDANT TREATMENTS FOR WOOD SHINGLES

U.S. Department of Agriculture, Forest Products Laboratory. May 1971. 29 pages.

AD–726 325

In areas where it is economically available, the architectural usefulness and desirable appearance of wood makes it material of choice for shingles. The availability of acceptable fire-retardant treatments would further improve the utility of wood shingles and shakes. For this reason, numerous fire retardant systems were evaluated in an effort to provide a distinct differentiation between treatments that could or could not be expected to maintain good fire behavior in exterior service. Four treatments promised the most fire protection following weather and leaching exposures. The report describes the treatments and discusses the results of the effort.

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MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

Bonding and Joining

EXPLOSION WELDING OF CYLINDRICAL SHAPES

Frankford Arsenal. Harry J. Addison, Jr., James F. Kowalick, and Winston Cavell. May 1969. 27 pages.

AD–694 359

The explosion welding of concentric cylindrical components is a means of joining metals which are otherwise difficult or impossible to weld. In the detonation of a centrally located explosive, no external heating, cleaning, fluxing, or gas shielding is required. The document covers theory, joining requirements, and methodology. Supersonic and subsonic detonation rate explosives are discussed. The gap technique in which the walls of the members are positioned parallel to each other and the angular technique in which the walls are inclined at an angle are described. Various metallic combinations are reported on.

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ADHESION BONDING

Defense Documentation Center. April 1970. 140 pages.

AD–704 525

Approximately 100 summaries are provided of reports, published in the period 1945-1969, pertaining to the bonding of metals, composite materials, crystals, and other materials with adhesive substances. Most of the reports are the results of U.S. Government funded research. Consideration is given to the techniques and effectiveness of manufacturing methods, process control, and quality control of sealing compounds and adhesive for bonding. All of the reports listed are available from NTIS.

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INERT GAS WELDING

Defense Documentation Center. July 1970. 91 pages.

AD–709 900

Inert gas welding, in which the arc is surrounded by a gas such as argon or helium, has the advantages of producing no slag residue and requiring no flux. This indexed bibliography, covering the period 1960–1969, is comprised of summaries of reports generated as a result of U.S. Government funded research in the area of inert gas welding. The subject matter covered deals with welding techniques as well as the characteristics of the resulting welds. The reports cited are available from NTIS.

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SPOT WELDING

Defense Documentation Center. August 1970. 84 pages.

AD–710 450

Spot welding is a lap resistance welding method used primarily for thin sheet materials and electronic components. An indexed bibliography, covering the period 1953–1970, is provided which contains summaries of reports generated through U.S. Government funded research on spot welding. The reports cited are available from NTIS.

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PULSED-CURRENT ARC WELDING PROCESSES

Battelle Memorial Institute. J. J. Vagi, H. W. Mishler, and M. D. Randall. September 1970. 29 pages.

AD–712 364

Inert gas shielded arc-welding processes are widely used for joining various metals and alloys. A pulsed current produced by alternating high and low current is being favored in many instances to a single current level. The document discusses tungsten arc and metal arc methods and their output products, noting advantages of better heat control that allow thinner or thicker metals to be welded, increased quality control, and less stringent skill requirements of operators. Descriptions are given of welding equipment, kinds of materials joined, welding processes, and applications. Time, control characteristics, accuracy, and power data are included.

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WELDING OF ALUMINUM AND ALUMINUM ALLOYS

Battelle Memorial Institute. R. P. Meister, and D. C. Martin. April 1967. 76 pages.

AD–815 691.

Aluminum alloys are quite suitable for engineering applications that require lightness of weight coupled with strength, corrosion resistance, and cryogenic reliability; these structures, however, require welding. The very high strength aluminum alloys such as Al-Zn-Mg-Cu (alloy 7178) are difficult to weld without cracking, and considerable research is going into methods of welding aluminum and its alloys. The document discusses a group of copper free experimental alloys in the Al-Zn-Mg group, and another combination incorporating silicon, which have been welded by the gas metal arc and the gas tungsten arc processes. A description of aluminum and aluminum alloy welds is given, with recommendations for heat input and plate parameters. Sources of welding problems such as hydrogen contamination are called to attention, and procedures for joining dissimilar metals are noted.

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EXPLOSIVE BONDING

Battelle Memorial Institute. V. D. Linse, R. H. Wittman, and R. J. Carlson. September 1967. 32 pages.

AD–820 736

The explosive bonding of metals is analyzed as an oblique plate collision, or jetting, process in which atomic and molecular forces interact at an interface to produce a fluid mixture of surfaces. Such metallurgical bonding is considered to be brought about by progressive processes in the detonation of the explosive, occurring at some rate of fluid flow. The mechanisms of explosive bonding are outlined, along with data on proper tooling and the control of elastic plastic effects. A listing is given of ferrous and nonferrous metals that have been bonded to themselves, and of dissimilar metal combinations that have been successfully bonded, plus typical configurations that have been so bonded. Bonding equipment including vacuum chambers, techniques, and types of welds are described.

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WELDING TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 25 pages.

N71–23776

A number of welding techniques developed by or for NASA have potential applications outside of the aerospace industry. A variety of innovations has been made in methods for joining metals with a degree of efficiency adequate to contain gases at high pressures or fluids throughout a wide temperature range. Also, means have been developed for the handling of difficult weld configurations. Even those tubes previously considered almost inaccessible can now be welded with little or no risk of distortion, as can surfaces of varying thickness. Simultaneous welding techniques also have added to the ever-widening scope of metallurgical fabrication. The document describes these techniques and provides a form for requesting additional technical information.

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Building Technology

PROPOSED LOW-COST WINDOW UNIT

U.S. Department of Agriculture, Forest Products Laboratory. B. G. Heebink. January 1970. 7 pages.

AD–719 308

Window sash and window frames have always required considerable maintenance. Also, the original cost of the units and the installation labor represent a relatively high percentage of the cost of the structure. The report presents a new concept of a window unit, designed primarily for low-cost houses. The proposed window has permanently mounted glass as the main unit, with a transom ventilating unit above. Prototype models promise substantial savings over conventional construction.

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HANDBOOK FOR BUILDING HOMES OF EARTH

Department of Housing and Urban Development. Lyle A. Wolfskill, Wayne A. Dunlop, and Bob M. Callaway. 1970. 161 pages.

PB–188 919

Homes constructed of soils and clays are in use in many parts of the world. Research required in road construction has produced a knowledge of how to produce soil mixtures excellent for house construction. The document gives an in-depth treatment of earth construction, including data on soil analysis and stabilization, site selection and preparation, foundations, walls, floors, roofs, and surface coatings. It describes adobe production, soil treatments, and methods of making earth blocks. Detailed instructions are given on soil and clay identification, testing, and layout. Do's and don'ts are included. The data intended for use by persons without prior knowledge of how to build an earth home.

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PLANNED INDUSTRIAL PARKS

Department of Housing and Urban Development. Victor Roterus, Lloyd D. Black, and Theodore K. Pasma. June 1969. 22 pages.

PB–188 924

The planned industrial park is the cooperative modern response of enterprise and civic leadership to a demand for the curb of blight in urban commercial areas. The document considers this type of development as the counterpart of a landscaped residential subdivision, reporting on the types of parks as developed by railroads, commercial profit-seeking groups, non-profit organizations, and communities or local governments. The selection of parks is given attention, and examples of currently operating parks are noted. Internal planning is discussed, with a review of safeguards, advantages to manufacturers, advantages to the economic community, and benefits to the urban social environment.

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BIBLIOGRAPHY ON HOUSING BUILDING AND PLANNING

U.S. Department of Housing and Urban Development. May 1969. 47 pages.

PB–188 927

The document contains a selection of approximately 400 recent books and periodicals on housing building and planning. A descriptive statement is included for most of the entries. The publications concern such subjects as aided self-help housing, architecture, building codes and standards, city and regional planning, housing, land problems, taxation, transportation, urbanization and zoning.

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AIDED SELF-HELP IN HOUSING IMPROVEMENT

Department of Housing and Urban Development, Division of International Affairs. August 1969. 64 pages.

PB–188 931

Aided self-help as a means of improving living conditions at reduced costs and at an accelerated pace is especially effective for housing. The method utilizes the many man-hours that are available in most areas in the form of unused leisure time together with some form of aid from the community or other source to help man improve his shelter to an extent that he never could alone and unaided. The principle can be adapted to an infinite variety of techniques, ranging from those which produce a complete modern house to a system whereby an insanitary thatched roof covering is replaced with metal sheets. Aided self-help is a very effective method to encourage home ownership and is the only known method which offers hope for large-scale housing improvements in many parts of the world. The report provides information on how to organize self-help projects and secure technical and financial assistance.

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DEMONSTRATION IN LOW-COST HOUSING TECHNIQUES

California State Department of Housing and Community Development. Charles R. LeMenager, Ed Bowe, and Dean C. Hill. June 1970. 110 pages.

PB–194 757

A need exists for a means of developing housing to be utilized for low income domestic and migratory farm workers. A study was made of methods of construction, building materials and supplies, and building plans which would produce inexpensive housing. The report reflects building costs and building construction features, as well as the undesirable features of these structures. The report includes floor plans of some of the structures.

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Civil Engineering

HYDRAULIC FLOW RESISTANCE FACTORS FOR CORRUGATED METAL CONDUITS

Federal Housing Administration. Jerome M. Normann, and Herbert G. Bossy. September 1970. 50 pages.

AD–723 603

A highway drainage structure may consist of corrugated metal sheets fashioned into circular pipes and conduits; the corrugation configuration has been found to be important to the hydraulic characteristics of such structures as well as their geometric form and size. The document considers the hydraulic resistance of conduits, pointing out the necessity for developing different resistance factors for different forms, rather than attempting to use a single factor for all variations. Experimental data are presented for five corrugation configurations, and mathematical models of flow are formulated. The discussion covers such influencing parameters as surface roughness, Reynolds number, and manufacturing methods. Results are given in tabular and graphic form.

CHARACTERISTICS PRESSURE DISTRIBUTION IN CONDUIT INLETS OF EARTH DAM FLOOD CONTROL OUTLET WORKS

Army Engineer Waterways Experiment Station. Yen-Hsi Chu. June 1969. 78 pages.

AD–724 537

Outlet works provided for certain dams with low flow release consist of rectangular conduits located at the overflow section in the case of a concrete dam and within or adjacent to an earth dam. The document discusses the problem arising in high kinetic energy of outlet flow as related to design of the outlet and associated inlet. It contains a summary of entrance pressure measurements using nine hydraulic models and gives the results of two test programs for earth dam entrance designs. Two dimensional and three dimensional inlets are analyzed, and mathematical models are formulated. Correlations of experimental data are made in regard to upstream face geometry, guide piers, and bulkhead and gate slots.

PROCEEDINGS OF THE ANNUAL LAND SURVEYOR'S CONFERENCE, JANUARY 1970

Kentucky University. 1970. 55 pages.

PB–191 326

The document is comprised of papers presented at the conference, which was designed to disseminate information to land surveyors in Kentucky. Topics include: Surveying personnel, personnel management of clerical and unskilled help, orthophographic mapping, aerial photogrammetry for property surveys in mountainous terrain, land surveying monumentation, error analysis, analytical aerotriangulation as applied to reservoir planning, and allied topics.

Control Systems

FLUERICS. STATE-OF-THE-ART 1969

Harry Diamond Laboratories. Joseph M. Kirshner, and Richard Gottron. December 1969. 36 pages.

AD–703 117

A need for improving the reliability of control systems has led to the development of no-moving-parts fluid apparatus based on the momentum interaction of fluid streams. The document discusses flueric devices as the fluid analogs of electric circuit elements, pointing to their effectiveness as proportional amplifiers, digital switches, flip flops, logic agents, and the like, but noting deficiencies as diodes or certain capacitors. Theory and operation are covered for a number of applications, including sensors and interface devices such as mechanical-electrical systems, pressure difference systems, energy conversion systems, and input and output devices. A review of the state-of-the-art is given.

AN INTRODUCTION TO OPTIMAL CONTROL THEORY

Wisconsin University. Aaron Strauss. November 1969. 156 pages.

AD–703 193

Materials are presented from the author's lecture notes on the mathematical basis of control theory. The document is mainly a mathematical development, discussing the solution of control problems in measurable control as the application of an ordinary differential equation, a control region, an admissible control class, an initial point, and a target. A railroad train example, involving the bang bang principle in which the control is always at its maximum positive or negative value, is given. Time functions and cost functions are included. A discussion follows of controllability, linear time optimal systems, existence, and necessary conditions. The selection of a best approach with respect to some performance criterion is considered, as well as the use of control response relationships.

REQUIREMENTS FOR THE DIGITAL CONTROL OF ELECTROPLATING PROCESS

Watervliet Arsenal. John W. Pym, and Chi-Neng Shen. April 1970. 24 pages.

AD–708 858

In the electrodeposition of two metals to give an alloy of specified composition, the ratio of the metals in the deposit cannot be measured directly while plating is in progress. Hence, control of the metal deposit ratio must be achieved indirectly by control of the conditions in the electroplating bath. Various modes of control for such a process are discussed. The advantages of a digital system for such control are presented and compared to an analog system. The equipment necessary to implement the digital control system is specified.

FLUERICS. A BIBLIOGRAPHY

Harry Diamond Laboratories. April 1970. 342 pages.

AD–709 497

Fluerics, a field of control systems in which the interaction of fluids replaces moving parts, is being utilized more and more in mechanical engineering. The document contains an extensive annotated bibliography on work pertinent to fluid amplification. A reference listing of keywords is given (KWIC index), ranging from absolute pressure ratio computers to zones of mixing, along with document identification for each entry. Articles, books, and symposium papers are indexed by author, patent, and inventor. Organizations are named from which information on fluidics and fluerics may be obtained.

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FUTURE FIELDS OF CONTROL APPLICATION

National Aeronautics and Space Administration, Electronics Research Center. August 1969. 151 pages.

N71–14426

The document is comprised of papers that were read at a symposium sponsored by NASA's Office of Control Theory and Application which was held in Boston, Massachusetts, 10–11 February 1969. The topics include: Possible areas of control theory in print communication; biological cybernetics; air transportation; urban studies; World Bank operations in less developed countries; industrial production problems; biological oceanography; meeting future control challenges.

◆

COMPUTER-ASSISTED, ADAPTIVELY CONTROLLED MACHINE TOOL SYSTEMS

Union Carbide Corporation. T. L. Williams. October 1969. 26 pages.

Y–1692

Since the advent of numerically controlled machine tools in the early 1950's, considerable progress has been made in their application. These controllers have made possible the manufacture of intricately precise parts that were previously impracticable, if not impossible, to achieve. An advance over the conventional numerical controller is the computerized adaptive controller; i.e., a control system provided with a means of monitoring its own performance and modifying its own control parameters to meet changing conditions. This report represents the results of a study of the present state-of-the-art of computer controlled machine tool systems and real-time adaptive control techniques. It is intended to summarize what industry has done with such systems.

◆

PUNCHED-TAPE CODE AND FORMAT FOR NUMERICALLY CONTROLLED MACHINES

Union Carbide Corporation. R. V. Miskell. November 1969. 15 pages.

Y–1702

There is a wide variety of numerical control systems found in industry today. The terminology used to describe the tape codes and formats used on the punched tape for these controls is not uniform. An understanding of this terminology facilitates communication between the purchaser of numerically controlled equipment and supplier, the part programmer and shop foreman, and the part programmer and computer programmer. This report is intended to serve as a handy educational assist to the numerical control community. It contains a description of the punched tape code and format used on the newer numerical control systems, and discusses the different codes, formats, and data.

◆

STUDY OF NUMERICAL SYSTEM AVAILABILITY AND MANPOWER REQUIREMENTS

Union Carbide Corporation. George R. Bright. April 1970. 110 pages.

Y-1721

The application of numerical control to a machine tool provides a new method of control for the machine industry. This method involves the automatic operation of the machine tool from digitally coded instructions, which control the tool's position and cutting path on the workpiece. With the introduction of numerical control methods, the direct labor content of the finished product becomes less and maintenance costs become the major controllable factors. A method has been developed, and is described in the report, whereby managers of numerical control maintenance can make decisions which may result in better continuity of operations and more efficient utilization of manpower.

◆

CUBIC INTERPOLATION FOR NUMERICALLY CONTROLLED MACHINES

Union Carbide Corporation. R. V. Miskell. March 1971. 54 pages.

Y–1782

There are two basic types of numerical control systems for automatically controlling machines or processes. These are the point-to-point, or positioning, control and the continuous-path, or contouring, control. Whereas a positioning control only insures the final position specified by the input command on tape, a contouring control continuously controls the positions of the machine slides along the path to the target point. One component of the latter type of system is the interpolator, which is designed to issue pulse trains to the machine at a number and rate to direct the numerically controlled machine to make a specific line or curve. The generation of these pulse trains from input data is called interpolation. This report describes a third-order interpolation technique based on the digital integration of parametric cubic equations. The use of this "cubic interpolator" can reduce data requirements for numerically controlled machines and still maintain dimensional and velocity accuracies.

◆

FLOOD PROTECTION AT CULVERT OUTLETS

Colorado State University. D. B. Simons, M. A. Stevens, and F. J. Watts. 1970. 232 pages.

PB–196 972

The document is concerned with the design of culvert outlet energy dissipation structures. Four types of basins are discussed and recommended, three of concrete and one rock riprapped, choice depending on available rock and the physical limitations of the design site. Benefit cost features of the various constructions are related to initial investment, structural life, and maintenance. Results of an investigation project undertaken with the cooperation of Colorado State University are reported on channel stabilization, under the headings of site location at culvert outlets or bridges, materials used, and techniques for cost control. The general purpose of the work is to develop design criteria for erosion control downstream of hydraulic structures.

◆

PRESPLITTING

California Division of Highways. Travis Smith, Marvin McCauley, and Ronald Mearns. February 1971. 39 pages.

PB–199 352

Presplitting is a potentially useful controlled blasting technique for constructing cuts in rock. It consists of developing a fracture surface along the plane of the designed slope by drilling holes in the plane and detonating light charges in these holes prior to any primary blasting. Application of this technique to highway cuts in California was found to produce cut slopes with a better appearance and the need for less scaling, even in highly fractured and faulted rock, than are produced by the more commonly used methods. The document discusses factors which were found to contribute to obtaining satisfactory results with presplitting. In addition, the results of an economic analysis of the technique are given.

◆

A SYSTEMATIC PROCEDURE FOR MINIMUM COST DESIGN OF HIGHWAY BRIDGES

Louisiana State University. Rodolfo J. Aguilar, Kambiz Movassaghi, and John A. Brewer. December 1970. 46 pages.

PB–200 418

Highway bridge construction methodology may be optimized through the utilization of mathematical models which incorporate critical factors such as soil and terrain conditions, structure geometry, forces, and construction costs. Optimization aims to produce an algorithm suitable for computer programming for a type of bridge. The document discusses research on cost minimization in the construction of a bent or simply supported bridge, in which the bridge length is allocated into a given number of spans and the selection of components for each span is determined. A computer program is formulated, with dynamic programming being used to develop the model and its solution. Efficiency, speed, and ease of construction are the principal requisites sought.

❧

AIR POLLUTION ASPECTS OF EMISSION SOURCES: CEMENT MANUFACTURING. A BIBLIOGRAPHY WITH ABSTRACTS

Environmental Pollution

Environmental Protection Agency, Office of Air Programs. May 1971. 51 pages.

PB–200 080

Cement manufacturing is a potentially significant source of air pollution. The document is comprised of approximately 130 abstracts of articles and reports dealing with cement manufacturing as an emission source. Specific topics include: Emission sources, control methods, measurement methods, air quality measurements, atmospheric interactions, human health effects, effects on plants and livestock, effects on materials, economic effects, standards and criteria, legal and administrative considerations. An index is included.

❧

IN-PROCESS MANUFACTURING QUALITY CONTROL

Industrial Engineering

Massachusetts Institute of Technology. Donald E. Lewin. January 1971. 558 pages.

AD–720 098

When manufacture of an item reaches the stage where production line methods are employed, quality control becomes a major factor in the process. A monitoring system becomes necessary for inspecting the output, detecting defects, and rectifying whatever the shortcoming may be. The document considers the elements operating in such a system, using fabrication of a typewriter as an example, and notes how the effort to obtain a reliable quality control is organized. A discussion is presented of what constitutes a defect, what means can be installed to detect it, and what levels of adjustment can be made available; of equal importance is the problem of how maintenance of a desirable level of quality and reliability can be secured. Topics given detailed treatment include lot sampling technology, cost effectiveness of controlling quality, and the optimum allocation of processes between detection of defects and rectification of faults. A computerized simulation is offered as one means of establishing optimums, along with application of mathematical models, such as the Bernoulli residual information model.

❧

A NEW APPROACH TO JOB SHOP SCHEDULING WITH DUE DATES

California University. Charles A. Holloway, and Rosser T. Nelson. April 1971. 45 pages.

AD–725 838

The document considers an approach to job shop scheduling which offers a substitute for the current concept of doing the best possible under fixed conditions and fixed resources. The revised concept involves the seeking of a fixed goal under variations of constraints and resources. The work reported views the goal and resources as fixed but the constraints as flexible, with optimality sought in satisfying due dates along with feasibility in satisfying technological constraints. A procedure is described which was computer programmed and mathematically modeled for a set of 19 test problems, and for which solutions were obtained. The results are of 19 test problems, and for which solutions were obtained. The results are discussed, and flow charts are appended.

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A NEW STORAGE SYSTEM FOR INCREASING THE USABLE CAPACITY OF A WAREHOUSE

Sandia Laboratories. E. E. Alford. October 1969. 12 pages.

PB–187 816

The efficient use of floor space is a major consideration in storage facilities. A new warehouse storage system, based upon handling the pallet rack as a unit load, is described. The new system reduces the number of aisles and thereby increases the warehouse's usable storage capacity. Substantial cost savings are possible over a wide range of storage applications.

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Machinery and Tools

AN ENGINEER'S GUIDE TO FRICTION

Battelle Memorial Institute. W. A. Glaeser. February 1970. 16 pages.

AD–702 441

The document emphasizes the need for knowledge on solid-contact friction, pointing out the difficulties encountered by the engineer in dealing with problems involving frictional forces. The lack of effective mathematical means of predicting real frictional properties from theory is noted, relating as these do to the interactions of materials, the effects of temperatures and loading, and the surface characteristics of shapes and forms, plus the effects of sliding speeds. A demonstration is given of the unpredictable nature of friction variability, and the author observes upon the misapplication of coefficients which attempt to express frictional qualities.

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INTERACTIONS AMONG THE VARIOUS PHENOMENA INVOLVED IN THE DESIGN OF DYNAMIC AND ROTARY MACHINERY AND THEIR EFFECTS ON RELIABILITY

Arizona University. Dimitri Kececioglu, and Edward B. Haugen. August 1970. 468 pages.

AD–716 017

As the designing of optimized components in industrial machinery becomes of increasing concern, so do methods of increasing reliability. The document reports one phase of a research program on shaft reliability as part of an intensive study of dynamic and rotary machine elements. Of particular interest are stress failure and stress strength, statistical analyses of physical and mechanical properties of steel, design phenomena interactions, development of testing equipment, measurement of fatigue and durability characteristics, and experimentation technology for cold drawn and annealed steel.

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AN INTEGRATED NEAR-OPTIMUM DESIGN OF COLD ROLLING MILLS

Illinois University. Mohammed Jamshidi. January 1971. 126 pages.

AD–717 401

In many industrial processes the digital computer has been incorporated to an increasing extent into the design of optimal control systems, leading to increased research in the field. The document is concerned with further advances, presenting an integrated near optimum system of control, as applicable to a high speed cold rolling steel mill in which 45 control variables are involved. The method includes dividing the several variables into slow, basic, and fast categories, eliminating the slow and fast divisions, and computing the control by using the basic variables. Both linear and nonlinear dynamic and space models are discussed for a three-mill stand.

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ELASTOHYDRODYNAMIC LUBRICATION PRELIMINARY DESIGN MANUAL

Air Force Aero Propulsion Laboratory. J. M. McGrew, A. Gu, H. S. Cheng, and S. F. Murray. November 1970. 352 pages.

AD–877 768

Lubrication of rolling contact bearings, such as those used in turbomachinery, involves the theory of elastic bearing behavior. Elastohydrodynamics describes the fluid-mechanical interaction of contact surfaces undergoing elastic deformation in the presence of a lubricant. where both surface and lubricant properties are significant. The document reports on a survey and analysis of available data on elastohydrodynamic lubrication; an experimental effort to determine contact factors, critical lubricant properties, and interaction phenomena; and development of a manual containing basic design and selection information on bearings for aircraft turbomachinery. The procedure includes calculation of minimum film thickness, real area of contact, traction, pressure distribution, temperature profile, and subsurface stress distribution in the contact. A computer program was used for calculations, and the results are presented largely in graphic and tabular form.

◆

LUBRICATION CONSIDERATIONS IN GEAR DESIGN

National Aeronautics and Space Administration, Lewis Research Center. D. P. Townsend. 1970. 35 pages.

N71–14785

The main function in the lubrication of gearing is to prevent the scoring and fatigue failure of the gear contact surfaces. Mechanical and service variables must be considered to obtain optimum gear performance under severe operating conditions. Gears operating under boundary and mixed lubrication require added protection by using extreme pressure and antiwear additives to prevent failure. The document discusses the method of elastohydrodynamic film formation and how the lubricant properties affect the film. An analytical method for determining elastohydrodynamic film thickness from theory and how the film affects gear failure mode and life is presented.

◆

HAND TOOLS: A COMPILATION

National Aeronautics and Space Administration. 1970. 27 pages.

N71–23910

A number of hand tools developed by or for NASA have potential applications outside of the aerospace industry. Mechanical tools and electrical tools, modifications of existing tools, and techniques have been developed with emphasis upon safety, ease of operations, and use in restricted areas or hazardous environments. The tools are especially applicable in assembly or maintenance of mechanical or electrical equipment. The document describes these tools and provides a form for requesting additional technical information.

◆

MACHINE TOOLS AND FIXTURES: A COMPILATION

National Aeronautics and Space Administration. 1970. 21 pages.

N71–24078

A number of machine tools and fixtures developed by or for NASA have potential applications outside of the aerospace industry. In many cases, use or modification of these tools and fixtures can result in considerable cost savings. Industry should find these items economical, efficient, and time saving, as well as contributory to better quality products. The document describes these tools and fixtures and provides a form for requesting additional technical information.

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MACHINING

Defense Documentation Center. March 1970. 122 pages.

AD–702 650

Summaries are provided for reports generated during the period 1953–1969 by U.S. Government funded research on machining. The subject includes machining variables such as tool materials, tool geometry, cutting fluids, depth, feed, tool life, and the effects of workpiece material properties. The documents cited are available from NTIS.

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CHEMICAL MILLING

Defense Documentation Center. March 1970. 129 pages.

AD–702 750

Chemical milling is a method of processing metal forms in acid or alkali baths in order to remove all or part of the surface. In contrast to mechanical milling, the method avoids deforming and weakening the material. This indexed bibliography contains the abstracts of about 100 U.S. Government funded research reports which were published during the period 1953–1969. The subject matter includes the capabilities and limitations of chemical milling techniques, materials for which it is suitable, and the quality of the finished surface. All of the reports listed are available from NTIS.

* * *

FORGING

Defense Documentation Center. March 1970. 98 pages.

AD–702 800

The document is a compilation of summaries of U.S. Government funded reports on metal forging. The subject matter covered includes forging methods, materials, equipment, and applications thereof. The reports listed are available from NTIS.

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ETCHING

Defense Documentation Center. March 1970. 161 pages.

AD–703 200

This indexed bibliography is comprised of summaries of U.S. Government funded reports on etching. The reports cited deal primarily with the capabilities and limitations of etching techniques, materials for which they are suitable, and the different etchants and solutions used in the process. All of the reports listed are available from NTIS.

* * *

CLADDING

Defense Documentation Center. March 1970. 62 pages.

AD-703 450

Cladding involves the mechanical application of a sheet on one metal to a base stock of another, thus supplying a combination of properties not found in any single metal. This indexed bibliography, covering the period 1953–1969, provides summaries of reports on cladding research funded by the U.S. Government. The subject matter includes methods of cladding, cladding alloys, reactor fuel cladding, and various cladding applications. The reports listed are available from NTIS.

◆

ELECTRODEPOSITION

Defense Documentation Center. March 1970. 204 pages.

AD-703 800

The document is comprised of summaries of 167 reports, covering the period 1953-1969, resulting from U.S. Government funded research on the coating of metal and composite materials by electrodeposition. The reports are available from NTIS.

◆

SPUTTERING

Defense Documentation Center. April 1970. 158 pages.

AD-703 900

Sputtering is a process by which atoms or groups of atoms are ejected from a metal surface as the result of heavy-ion impact. It is useful for certain processes, such as cleaning surfaces and depositing metallic films. This annotated bibliography contains references to 121 reports, published in the period January 1953–December 1969, dealing primarily with sputtering techniques and applications. The reports were funded by the U.S. Government and are available from NTIS.

◆

VAPOR PLATING

Defense Documentation Center. April 1970. 112 pages.

AD-704 450

Vapor plating research reports are summarized in this bibliography of 79 references, covering the period January 1953-January 1970. These references pertain to metal films, thin films, semiconducting films, metal coatings, crystal growth, refractory materials, process development, manufacturing methods, and research and development of the vapor plating techniques. The research was funded by the U.S. Government and the reports cited are available from NTIS.

◆

MACHINE SHOP PRACTICE

Defense Documentation Center. May 1970. 85 pages.

AD-707 200

The indexed bibliography, covering the period January 1953-March 1970, contains summaries of 63 research reports generated with U.S. Government funds. The reports relate to techniques, procedures, manufacturing methods, time studies, and shop layout in machine shop practice. References dealing with automation and shop maintenance procedures are also included. The listed reports are available from NTIS.

◆

TECHNIQUES IN PLATING

Defense Documentation Center. July 1970. 128 pages.

AD-709 950

This indexed bibliography, covering the period January 1959-December 1969, contains summaries of selected references on techniques in plating and coating. The references deal primarily with types of plating, materials used for plating, and plated surfaces. The mechanical properties of deposited protective coatings are discussed. The reports listed are a result of U.S. Government funded research and they are available from NTIS.

◆

EXPLOSIVE FORMING

Defense Documentation Center. August 1970. 114 pages.

AD-710 550

Explosive forming is a method of shaping, or modifying metals by means of explosions. This method is advantageous over conventional forging methods especially in the case of intricate shapes of which only a few items are required. Tooling costs are low. This indexed bibliography, covering the period January 1960—June 1970, contains abstracts of 83 research reports funded by the U.S. Government. These reports are available from NTIS.

◆

A STUDY OF MECHANICS OF CLOSED-DIE FORGING

Battelle Memorial Institute. T. Altan, A. F. Gerds, D. E. Nichols, H. J. Henning, and R. J. Fiorentino. August 1970. 188 pages.

AD-711 544

Modern industry is increasing its use of analytical approaches to the design and control of metalworking processes. In some cases of hot metal operations, such as in cavity or closed die forging, complex theory is involved for which computer technology is advisable. The document discusses theory and analysis of metal flow in cavities under pressure, heat exchange processes, and deformation rates. The advantages of screw type presses are noted.

Tests are described using simulating materials to predict the cold-forming properties of steel and similar metals. A major effort in the experimental program covered in the report was directed to deriving shape difficulty factors for various die forged parts. Factors important to the selection and use of forging equipment are outlined. The mathematical bases as supplied by computer analysis are discussed.

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ZONE REFINING

Defense Documentation Center. August 1970. 145 pages.

AD-712 000

Zone refining is a technique for producing high purity materials (primarily semiconductor materials and metals). This indexed bibliography, covering the period January 1960—June 1970, contains 105 references to research reports funded by the U.S. Government. The reports cited are available from NTIS.

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ENVIRONMENT-SENSITIVE MACHINING BEHAVIOR OF NONMETALS

Research Institute for Advanced Studies. A. R. C. Westwood, and R. M. Latanision. October 1970. 56 pages.

AD-713 595

A report is made on the machining of nonmetallic substances such as hard ceramics, glass, and minerals, for all of which the specific drilling mechanisms are poorly understood. A correlation deemed important is the infiuence of an active environment on near-surface flow behavior which must involve a total cutting system consisting of the environment, the solid, and the tool. Liquid environments are considered which may be cooling, lubricating, or dispersing, with adsorption entering as a major factor; experiments are described using various liquids. The mechanisms of penetration are analyzed in relation to the chemical makeup of the material being machined and the composition of drills and bits. The incidence of fracture and cracking is discussed, with special attention to the behavior of glass. The results of scratch tests and other exploratory experiments are given.

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MATERIAL CUTTING, SHAPING, AND FORMING: A COMPILATION

National Aeronautics and Space Administration. 1970. 24 pages.

N71-24171

A number of material cutting, shaping, and forming techniques developed by or for NASA have potential applications outside of the aerospace industry. A variety of innovations have resulted in greater uniformity of result, time saving, and cost reduction. Even sophisticated and extremely hard metals such as rhenium are now amenable to forming and machining without risk of damage. The document describes these techniques and provides a form for requesting additional technical information.

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SURVEY OF SELECTED INDUSTRIAL APPLICATIONS OF MICROWAVE ENERGY

Bureau of Radiological Health. May 1970. 79 pages.

PB-191 394

Microwave energy is being increasingly developed in modern industry to compete with conventional heating systems for a number of applications. Some products cannot be produced or conveyorized in any other way. Long warm up and turnoff times are not required. Microwave equipment has higher efficiency and lower operating costs, takes up less space, and is easier to maintain than conventional systems. The document reports on operating methods, equipment design, current industrial applications such as food preparation, wood and concrete curing, and fungus control. Particular attention is devoted to safety and reliability. Considerable statistical data is provided.

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IONIZED FIELDS IN ELECTROSTATIC SEPARATION

Bureau of Mines. Foster Fraas. May 1971. 17 pages.

PB-200 047

A separation of dissimilar solid materials can be effected by the action of a rotary conveyer and an electric field. The document discusses the use of a rotating cylindrical electrode in an ionized field, widely used to separate conductors from nonconductors, extending the method to separation based on differences in surface-to-mass ratio and differences in geometric form. In each case a high intensity electric field opposes the centrifugal force of rotation. Two roller-type electrostatic separatiors are described, one in which charged units leave the surface of a rotating cylinder at different times according to their characteristics and the rotational speed, and another in which a moving mesh belt carries particles into the space between a large surface plane electrode and a wire or point electrode. Applications of these devices are noted for such separations as rubber particles from nylon fibers or strings from tobacco leaves, and in operations needed for secondary material recycling.

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BURNISHING METAL TO FINE FINISHES WITH A ROLLING BALL

California University. C. M. Gordon, and G. W. Roust. November 1970. 11 pages.

UCRL-50864

When a metal form is machined on a lathe, surface imperfections result from tool furrowing, the sluffing off of metallic buildups, spindle bearing eccentricities, tool chatter, machine virbration, and lubrication failure. The document describes a burnishing process by which the surface finish can be improved by rolling a ball mechanism, steel tube held under pressure, to compact surface elements, modify stresses, work harden in some cases, and improve reflectivity. Design problems of such an assembly are discussed, and the construction of the mechanism is presented.

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Marine Engineering

STRUCTURAL DESIGN REVIEW OF LONG, CYLINDRICAL, LIQUID-FILLED INDEPENDENT CARGO TANK BARGES

General Dynamics Corporation. C. W. Bascom. 1970. 110 pages.

AD-708 565

Reliable methods for the design of long, large diameter, cylindrical tanks and their supports are reviewed. The tanks are used for transportation of liquids and low-pressure liquified gases in barges for service on rivers or at sea. The report discusses loading conditions, existing design/analysis methods, material considerations, and a computer method for predicting stresses. Several areas in which theoretical or experimental effort is needed are identified.

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LITERATURE SEARCH AND CRITICAL REVIEW OF MECHANICAL FAILURE TECHNOLOGY

Mechanical Technology Incorporated. Marshall B. Peterson. July 1970. 546 pages.

AD-708 764

Control of mechanical failure is of top importance in marine propulsion engineering. In the effort to identify critical components and problems in mechanical equipment, to define failure modes and processes, to determine design techniques for predicting failure, and to establish diagnostic methods, an extensive literature survey was conducted. The areas of consideration were gas and steam turbines, gasoline and diesel engines, compressors, pumps, and heat exchangers. Data were sought on systems, materials, lubrication, contacts, mechanical parts, and seals; some specific components investigated were gears and couplings, splines, sliding bearings, cams, valves, piston rings, clutches, shafts, blades, mountings, and impellers. The elements of friction and wear received attention. The document reviews the findings under three heads: very slow or wearout, relatively rapid, and sudden or unpredictably catastrophic. The effects of operating errors and operating environments are also discussed.

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CARGO BOOM STUDY

General Electric Company. J. B. Makinson, R. S. Mosher, D. P. Bodine, E. J. Campbell, and P. F. Croshaw, November 1970. 225 pages.

AD-715 754

A large cargo handling boom with master-slave controls having spatial correspondence and force feedback is feasible. The Cybernetic Anthropomorphous Machine Systems (CAMS) cargo boom concept provides for a high degree of man/machine integration and has been shown to have signficant advantages over other systems, both from an economic as well as a utilitarian standpoint. The design makes use of conventional construction techniques and proven high strength materials and incorporates efficient structural and kinematic arrangements to minimize weight and power requirements without sacrificing performance. Machines capable of handling loads ranging from 2,500 to 7,500 pounds at reaches from 15 to 25 feet are feasible.

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PLASTIC MOORING BUOYS—DESIGN AND COST CRITERIA

Naval Civil Engineering Laboratory. Richard W. Drisko. April 1971. 37 pages.

AD-723 219

Fleet ship harbor moorings, including chains and mooring buoys, must be designed with a consideration of corrosion, wave action, durability, maintenance, and costs. The document presents an investigation of the feasibility of substituting plastic buoys for the steel ones currently used. Exposure data in reported for three designs of plastic buoy: a lay-up fiberglass reinforced polyester shell serving in San Diego Bay for five years, a spray-up fiberglass reinforced polyester shell in similar exposure, and a laminated fiberglass-resin buoy used in Pearl Harbor for two years.

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RECENT DEVELOPMENTS IN TRANSPORTABLE BREAKWATER RESEARCH

Naval Research Laboratory, Ocean Technology Division. Owen M. Griffin. May 1971. 31 pages.

AD-725 866

A breakwater serves to reduce the height and energy of incoming ocean waves. The document is concerned with development of transportable and floating breakwater systems for both shore and deepsea use. Of the three types of mobile breakwater—pneumatic and hydraulic, flexible, and rigid floating and fixed—one combining a large mass moment of inertia with a perforated body to aid in the dissipating of incoming wave energy is considered as most promising. Various structures are discussed for use as mobile landing areas, mooring areas, and piers or artificial harbors. Since such floating assemblies, however, are vulnerable to wave action, and since present mooring methods need improvement, model testing becomes of high importance, emphasizing the need for scale prototype models and test structures.

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TECHNICAL EVALUATION OF DIVER-HELD POWER TOOLS

Naval Civil Engineering Laboratory. S. A. Black, and F. B. Barrett. June 1971. 60 pages.

AD-726 161

The document is concerned with current research on underwater hand-held power tools intended for use by divers in construction, maintenance and repair work, and salvage operations in harbors or on ocean bottom. Four systems were evaluated in a shallow water harbor to provide data on tool and diver performance, plus maintenance, on pneumatic and hydraulic impact wrenches, a hydraulic chain saw, and a hydraulic grinder. Three power sources were used: a cryogenic power module utilizing liquefied nitrogen to generate gas for pressure, an electrohydraulic system utilizing storage batteries, and a diesel hydraulic unit; the first two were submersible and required no surface connections. The evaluation correlates system efficiency with human performance, energy output, and sea depth.

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GUIDELINES FOR DECK STOWAGE OF CONTAINERS,

J. J. Henry Company, Incorporated. July 1970. 129 pages.

COM-71-00022

GUIDELINES FOR DECK STOWAGE OF CONTAINERS APPENDIX

J. J. Henry Company, Incorporated. July 1970. 129 pages.

COM-71-00023

There is a problem within the maritime industry regarding losses to containerized cargo through structural damage to containers stowed above the weather deck under direct impact of waves, failure of restraint systems resulting in loss of containers, and damage to cargo within containers due to severe ship motions. The report provides guidelines for the securing and protecting of cargo containers for the use of the ship designer, ship operator, and container operator. The appendix to this report contains data and analyses which were used to prepare the guidelines.

* * *

Nondestructive Testing

USE OF ACOUSTIC EMISSION AS A WELD QUALITY MONITOR

Battelle-Northwest, Pacific Northwest Laboratory. W. D. Jolly. September 1969. 20 pages.

BNWL–SA–2727

Acoustic emission refers to the pressure waves released in a material as the material is fractured or deformed. The report describes acoustic emission monitoring of weld quality. The most important feature of the acoustic emission technique as opposed to other nondestructive testing methods is that the data are real time; thus, one can more effectively determine the causes of the weld defects. The wide-ranging applications of this technique are illustrated by examples of real-time data from submerged-arc, gas tungsten arc, and spot welding. As a supplement to established weld inspection methods, acoustic emission monitoring can result in reduction of re-work costs and improvement of weld quality.

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NONDESTRUCTIVE TESTS FOR WELDS IN HIGHWAY STRUCTURES

Ohio State University, Transportation Research Center. Merle L. Rhoten, Matthew J. Golis, Ronald Hudec, R. C. McMaster, and Peter K. Hayes. August 1970. 152 pages.

PB–196 141

Radiography is a well accepted nondestructive test for the inspection of structural weldments. The equipment required to produce the necessary penetrating radiations for industrial applications is usually large, heavy, and too cumbersome for field radiographic applications. The report describes the development and design of a self-contained x-ray machine for radiography of field weldments in bridges and other highway structures. This machine does not require an external electrical power supply and therefore is less costly and time consuming than currently used equipment. It also shows promise for various other applications where extremely high-energy short-term pulses are needed. A portable, semi-automatic ultrasonic weld scanner was also developed which produces a pictographic record of weld defects.

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ACOUSTIC EMISSION TECHNIQUES IN MATERIALS RESEARCH

California University, Lawrence Radiation Laboratory. R. G. Liptai, D. O. Harris, R. B. Engle, and C. A. Tatro. July 1970. 97 pages.

UCRL 72582

Acoustic emission techniques have wide applicability to experimental studies in materials research and to evaluation analysis of structural integrity. The techniques are very sensitive to dynamic transient processes in materials. The report discusses such transient processes as fracture toughness and crack propagation, fatigue, plastic deformation, and creep in metals, composites, and rock materials. The status of emission techniques as applied to the evaluation of structural integrity is reported. A complete discussion of experimental techniques and data acquisition and processing systems is given.

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NUCLEAR ENERGY CENTERS: INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES

Oak Ridge National Laboratory. November 1968. 227 pages.

ORNL–4290

The document reports on a study of nuclear powered industrial and agricultural centers as part of a research effort directed toward the economic betterment of areas which lack natural sources of energy. The establishment of nuclear powered agro-industrial complexes is discussed with special reference to developing countries. Statistical data are presented on the production of agricultural commodities, metals, chemicals, and water in deficient areas about the world. An economic analysis is made of planning procedures, complex construction, and cost management in relation to reactor engineering. Conclusions are drawn and recommendations are made.

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NUCLEAR ENERGY CENTERS: INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES—SUMMARY REPORT

Oak Ridge National Laboratory. July 1968. 30 pages.

ORNL–4291

The agro-industrial complex is a concept being investigated for developing countries, by which an area deficient in fossil fuels and hydraulic resources may become economically productive at relatively low cost through the utilization of nuclear energy. As a basis for establishing nuclear energy centers in deficient locales, the document cites the operation of several low-cost complexes about the world, including the production of gas, synthetic oil, and chemicals from low grade coal, and the operational activities in gas fields. Statistics are presented for a number of agricultural and industrial operations, the data appearing largely in tabular and graphic form.

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DATA OBTAINED ON SEVERAL POSSIBLE LOCALES FOR THE AGRO-INDUSTRIAL COMPLEX

Oak Ridge National Laboratory. T. Tamura, W. J. Young, and M. M. Yarosh. February 1971. 45 pages.

ORNL–4293

The document is concerned with the determination of sites about the world for establishing agriculture and industry which because of lack of power resources are not at present productive of either, but which might become so through use of nuclear power. The agro-industrial concept is discussed in this regard. The report indicates how areas could be made agriculturally productive on a year-round bases, and how utilization of nuclear energy in lieu of fossil fuel resources may be industrially attractive because of other area advantages. Desert regions are especially referred to.

Demographic considerations are discussed and forecasts are made for several coastal nations, and two locales are examined in detail, one in Florida, the other in Morocco.

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NUCLER ENERGY CENTERS: THE PROBLEMS OF IMPLEMENTATION

Oak Ridge National Laboratory. J. A. Ritchey. August 1969. 18 pages.

ORNL–4295

Establishment and successful operation of an engineering technology based on nuclear power is discussed as requiring stability in the planning system. The report is a review of the political, geopolitical, economic, and social factors entering into the framework of any nation, established or newly-formed. Establishment of an agro-industrial center is considered with respect to financing methods, cost engineering, the building of institutions for education and training, and the function of community facilities in the operation of both agriculture and industry. These factors are designated as implementation.

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PROCEEDINGS OF THE CONFERENCE ON UTILIZATION OF NUCLEAR TECHNOLOGY IN INDUSTRIAL OPERATIONS, CHARLESTON, WEST VIRGINIA, 1970

West Virginia University. August 1970. 112 pages.

PB–193 582

The symposium was directed toward extending the transfer of nuclear technology to industrial operations. Among the topics covered were the interactions of radioactive particles with matter, leading to such applications as the monitoring of coal moisture content and the measuring of mine dust explosive properties; neutron properties, with application to neutron radiography as a means of differentiating between isotopes or materials of similar atomic number, and to photographic processes more satisfactory than X-rays; radioisotope characteristics, as applied to oil well surveying where it is desired to see through earth and other structures, and process control in industrial engineering where accuracy, time conservation, and sensitivity are sought.

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Packaging and Containerization

A CRITICAL ANALYSIS OF THE STATE-OF-THE-ART IN CONTAINERIZATION

Control Systems Research, Incorporated. S. Berger, F. Heider, J. A. Lechus, R. L. Ralston, and I. C. Watson. November 1970. 273 pages.

AD–877 259

Containerization is basically the large scale unitization of cargoes by means of reusable, standardized boxes. Standardization enables the arrangement of ships' stowage facilities, shipboard and/or shoreside handling gear, and connecting modes of transportation for maximum efficiency and speed in performing cargo transfers. This state-of-the-art report on commercial containerization contains comprehensive coverage extending from the fundamental concepts, the operational environment, and damage analysis to evaluation of materials and assessment of design efficiency. Manufacturing methods are discussed, and maintenance is covered in sufficient detail to enable valid life cycle costs to be determined.

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PACKAGING AND CONTAINER TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 14 pages.

N71–24967

A number of packaging techniques and containers developed by or for NASA have potential applications outside of the aerospace industry. Properties such as durability, ease of handling, and weathering of several new containers and packaging assemblies provide the advantage of improving operations and reducing costs. The document describes these techniques and provides a form for requesting additional technical information.

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Pumps, Pipes, and Filters

DESIGN REQUIREMENTS FOR CAST IRON SOIL PIPE

Iowa State University. R. E. Untrauer, Ti-Ta Lee, W. W. Sanders, Jr., and M. H. Jaward. May 1970. 156 pages.

PB–192 517

Cast iron pipe installed under soil covering is subject to stresses produced by the surrounding earth, the geometry of its walls and fittings, and the characteristics of the joints between sections. Additional forces result from methods of manufacture and installation. The document is concerned with these stresses and the failures for which they are responsible, relating them to pipe dimensions, installation procedures, and service life. Joints studied are of the lead-oakum and gasket type. Caulking strains have been measured for 4, 8, and 12 inch pipes, and the effects of cooling are discussed. Mathematical models are derived for optimum pipe geometry.

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THE CONTINUED DEVELOPMENT AND FIELD EVALUATION OF THE AID HAND-OPERATED WATER PUMP

Battelle Memorial Institute. R. D. Fannon, Jr., and D. W. Frink. August 1970. 42 pages.

PB–196 340

One immediate need of a rural family or a small community is a safe and adequate water supply. Since contamination of an open well where a bucket and rope are used to bring water to the surface is easy, other methods are needed. The use of a hand operated pump presents the most favorable combination of methodology and maintenance. A simple, efficient hand-operated piston pump has been developed for manufacture and use in developing countries. The new design is said to make possible long life under rigorous operating conditions; ease of maintenance; manufacture with minimal investment; adaptation to both deep and shallow wells; and low production costs.

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FABRIC FILTER SYSTEMS STUDY, VOLUME I. HANDBOOK OF FABRIC FILTER TECHNOLOGY

GCA Corporation. Charles E. Billings, and John Wilder. December 1970. 649 pages.

PB–200 648

FABRIC FILTER SYSTEMS STUDY. VOLUME II. APPENDICES TO HANDBOOK OF FABRIC FILTER TECHNOLOGY

GCA Corporation. December 1970. 228 pages.

PB–200 649

FABRIC FILTER SYSTEMS STUDY. VOLUME III. BIBLIOGRAPHY

GCA Corporation. December 1970. 179 pages.

PB–200 650

FABRIC FILTER SYSTEMS STUDY. VOLUME IV. FINAL REPORT

GCA Corporation. December 1970. 130 pages.

PB–200 651

Fabric filters are used in many industries to remove dust for health reasons, materials recovery, and gas purification. They are used by such industries as the chemical, metal, mining, mineral, pharmaceutical, and wood industries. In fact, in any process where dust control or recovery is needed, fabric filters can be found. The four-volume report reviews these uses of fabric filters. It covers the following areas: current technology; current applications; air pollution control; and engineering. A comprehensive bibliography is included.

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Safety

MINIMUM NEEDS FOR AIRPORT FIRE FIGHTING AND RESCUE SERVICES

Gage-Babcock and Associates, Incorporated. Bert M. Cohn, and John A. Campbell. January 1971. 97 pages.

AD–720 512

Various aspects of aircraft firefighting and rescue systems are discussed and recommended minimum standards for utilization in the issuance of operating certificates to airports are presented. The report covers fire extinguishing agents suitable for airport crash protection, their application rates, the numbers and types of vehicles required for fire/rescue services, their response times, truck crews, costs of equipment and manpower, fire station locations, communication systems, protective clothing, and training.

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ANALYSIS OF AIRCRAFT FUEL TANK FIRE AND EXPLOSION HAZARDS

Dynamic Science. Thomas C. Kosvic, Laurence B. Zung, and Melvin Gerstein. March 1971. 85 pages.

AD–725 027

The inflight hazards of jet aircraft fuel tanks have been directly related to the fuel-air environment in the ullage or non-fuel-filled space within the tank. The document discusses the correlation of aircraft fire hazards to fuel-air concentration gradient, along with the effects of vibration, temperature, tank pressurization, and flammability. Computer models for analysis of fire and explosion hazards are presented. The results of simulated supersonic flight tests are given using gas chromatography.

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QUANTIFYING HAZARDOUS ELECTROMAGNETIC FIELDS: PRACTICAL CONSIDERATIONS

National Bureau of Standards. April 1970. 20 pages.

COM–71–00681

The increasing use of electronic equipment in industry, medicine, etc., has made imperative the development of methods for making easy, reasonably accurate survey measurements of biologically hazardous electromagnetic (EM) fields. A qualitative discussion is given of the many issues involved in selecting a suitable field parameter for quantifying hazardous EM fields in general. It is shown that the total energy density is the best parameter, but in many instances the electric energy density is adequate. Some general discussion is also given concerning "ideal" instrumentation for quantifying hazardous fields.

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EVALUATION OF THE HAZARD OF BULK WATER TRANSPORTATION OF INDUSTRIAL CHEMICALS: A TENTATIVE GUIDE

National Academy of Sciences-National Research Council. 1970. 32 pages.

PB–189 845

The report provides ratings that reflect the hazards or absence of hazards in shipping chemicals in their present industrial grades in bulk by water. Two-hundred and nine chemicals are rated with respect to fire hazards, health hazards, water pollution, and reactivity.

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MINE RESCUE AND SURVIVAL

Bureau of Mines. March 1970. 88 pages.

PB–191 691

The document is concerned with the saving of lives in coal mine disasters. Consideration is given to the types and locations of present bituminous coal mines, with statistics on fatalities in major disasters. Varieties of hazards are described; an analysis is made of the processes and sequences involved in fires and explosions; and the characteristics of methane gas, carbon monoxide, gas mixtures, coal dust, and obstructed ventilation are noted. Survival equipment for disaster environments is discussed. particularly breathing apparatus, and rescue systems are considered. These include refuge chambers, communication systems to locate trapped workers, and drilling operations to bore escape holes. Telephone, electromagnetic, and seismic techniques are outlined.

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A STUDY TO REDUCE THE HAZARDS OF TANK CAR TRANSPORTATION

Cornell Aeronautical Laboratories, Incorporated. W. A. Bullerdiek, F. A. Vassallo, D. E. Adams, and C. W. Matheis. November 1970. 172 pages.

PB–199 154

Transportation of chemical cargoes by railroad involves the possibility of an accident, with release of hazardous and inflammable materials upon rupture of container cars. The increasing use of large capacity pressure type steel tank cars for the shipment of liquefied compressed gases calls for improved safety measures against fire disaster. The report details the findings of a four month study on means of reducing the hazards of tank car transportation. These include studies of the thermal properties of cars and cargoes. A mathematical formulation is presented of combustion temperatures, fire volume and duration for vaporizing liquid propane, and heat transfer through tank car shells. Next the design possibilities of tank cars are considered, with special attention to safety factors and specifications. A discussion of possible safety devices and procedures for testing them is given. Finally recommendations are made for a safety relief system for liquefied compressed gas cargoes, with economic implications.

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Seals

SEALS

Defense Documentation Center. May 1970. 181 pages.

AD–706 000

Summaries are provided of U.S. Government funded research reports, covering the period 1955–1969, dealing with mechanical seal and sealing technology under the classifications of fuel and gas tank, hermetic and hydraulic, oil and O-rings, vacuum, rotary, and metal seals. Applications include aircraft, protective clothing, testing equipment and facilities, gaskets and packings, submersibles, energy storage, power plants, and machinery. Discussions appear on sea water resistance, storage effects, manufacturing methods, and mechanical properties. Among the materials covered are cork, synthetic rubber, lubricants, glass composites, organic materials, chemical compounds, plastics, and binders. The reports listed are available from NTIS.

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SEALS AND SEALING TECHNIQUES: A COMPILATION

National Aeronautics and Space Administration. 1970. 17 pages.

N71–23792

A number of seals and sealing techniques developed by or for NASA have potential applications outside of the aerospace industry. Innovations which have been made include fluorocarbon seal replacement for metal piston rings, low-temperature applications, seal lock, seal for emergency escape windows, and techniques for improving and forming seals. The document describes these techniques and provides a form for requesting additional technical information.

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Structural Engineering

CONCRETE FUNICULAR SHELLS FOR FLOORS AND ROOFS

Naval Civil Engineering Laboratory. Robert J. Odello, and J. R. Allgood. September 1970. 66 pages.

AD–712 754

A report is made on the concept of a curved surface concrete shell of funicular shape for use in constructing fireproof floor and roof systems where high loads or long spans are involved. The document discusses a rectangular top view, half lens side view, shallow shell as a replacement for the ordinary reinforced slab. Theory and examples of bubble shells are given, along with methods and problems of fabrication, and a description of air formed shells and the earth mound-lift technique is given. Reduction of costs appears to be an attractive factor. The results of tests of a concrete model are given under various loadings. Computer analysis of the test results was performed by means of two different programs designed for shallow rectangular shells, the results of which are included.

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INTEGRATION OF ANALYTICAL PROCEDURES FOR FRACTURE-SAFE DESIGN OF METAL STRUCTURES

Naval Research Laboratory. W. S. Pellini. March 1971. 80 pages.

AD–723 190

Fracture properties of metals are of primary importance in structure engineering. The document is concerned with the principles and practices of fracture-safe design of structural steels, noting that these vary with structure; thus, practices applicable to rocket cases may not apply to pressure vessels or ships, or bridges. Attention is called to the factors of crack propagation, flaws, and loading response. Research methods are discussed which are concerned with test specimens and criteria, the prediction of stresses, and safety factors. A description is given of fracture tests which provide data-bank references of metal properties. Mathematical models of mechanical properties are presented, and emphasis is placed on the use of analysis diagrams. The primary aim of the text is to press for utilization of modern practices in the design of engineering structures.

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OPTIMAL STRUCTURAL DESIGN

Bell Aerospace Company. Ronald A. Gellatly, and Laszlo Berke. April 1971. 74 pages.

AD–725 745

Since the design of a load-bearing structure must incorporate the factors of strength of materials, stiffness and stability, size and weight, and construction costs, it is necessary to seek an optimization method which considers them all. The report presents a mathematical approach to this problem, computer designed, which appears promising. It includes finite element analyses of four forms: a cylindrical rod, a triangular plate, and two varieties of trapezial panel. The computer analysis is applied to several test cases such as the pyramid, cantilever, and truss, iterations are performed, and final designs are evolved. Examples of application of the new approach to a number of construction problems are given.

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A STATISTICAL STUDY OF SOME DESIGN CONCEPTS IN EARTHQUAKE ENGINEERING

New Mexico University. Paul H. Wirsching, and James T. P. Yao. May 1970. 186 pages.

PB–192 693

Earthquake engineering is of particular importance in building structures which can experience severe seisms without suffering total collapse. The document is concerned with means of improving the safety of seismic structures. The use of low cost passive motion reducing devices is considered from the dual standpoints of collapse risk and repair. Simulation tests are reported for single story buildings using damped systems, vibration absorbers, an untuned velocity damper, and an isolation system. An analog computer was used to analyze strong-motion earthquake situations in combination with the Monte Carlo simulation technique. Dynamic structural response data were obtained, and a statistical distribution model was formulated.

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TABLES OF SIZES FOR DOUBLE-TAPERED PITCHED GLUED-LAMINATED BEAMS

Forest Products Laboratory. S. P. Fox. January 1971. 76 pages.

PB–198 002

Consideration is given to the design and properties of a glued laminated beam for supporting a roof. The document discusses a double-tapered pitched beam configuration, for which the working stresses and analysis formulae are given in recent Canadian timber engineering codes. Designing a minimum volume beam of the subject construction is noted as requiring use of a digital computer. Tables of data are presented for twelve spans, ten loadings, and four roof slopes.

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Technology Transfer and Utilization

A DDC BIBLIOGRAPHY ON COST/BENEFITS OF TECHNICAL INFORMATION SERVICES AND TECHNOLOGY TRANSFER

Defense Documentation Center. July 1968. 297 pages.

AD–672 500

The bibliography is concerned with benefit cost analyses of technical information services and of technology transfer. Reports are presented covering such topics as library performance in industrial research, Defense spending, and data management; costs of information acquisition, searching, and retrieval; technical information centers; management, personnel, and computer requirements; automation and computer programs; handbooks; transfer mechanisms, guidelines, and innovations; examples of transfer, such as aerospace-to-commercial industry; and data gained from information specialists.

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TRANSFER OF TECHNOLOGY FUNCTIONS EXTENDED: THE GERMAN CASE

Howard University, Department of Economics. Daniel L. Spencer, and Alexander Woromak. July 1969. 80 pages.

AD–695 117

Transfer of technology, the utilization of technical or engineering methods developed in one field for applications in another, is receiving increasing attention. The document considers two types of international transfer-function: impact or resulting output, and absorption or the ability of a society to use, a new technology. The case of Japan is presented, using data from Germany to construct applicable flow charts. In the discussion, transfer of technology is treated as a continuous cumulative process within a circular feedback system, the operation of which can be analyzed by means of identifiable variables which govern the absorption of a borrowed technology.

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SELECTED TECHNICAL SPIN-OFFS FROM THE SPACE PROGRAM

Air War College, Maxwell Air Force Base. Herman L. Gilmore. December 1970. 23 pages.

AD–722 090

Applied to technology, the spin-off is considered as an extra benefit or useful application in one field that develops from experimental investigation in another. The report deals with the value, often overlooked, of spin-offs from aerospace research to other domains, and discusses several examples and fields. These include transfer of technology from Apollo spacecraft to jet liners, space biomedical instrumentation to hospital techniques, spacecraft fire experience to fireproof textiles, satellite scanning systems to weather prediction, and airfield runway hydroplaning to highway engineering, among others.

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ACCELERATING UTILIZATION OF NEW MATERIALS

National Materials Advisory Board. May 1971. 106 pages.

AD–727 178

Today, more than ever before, the advance of technology of industry depends upon materials. In spite of the fact that great advances have been made in the development, processing, and application of engineering materials, substantial materials barriers remain in the way of the solution of various important technological problems. The document summarizes the findings of an effort to identify factors that promote or inhibit the use of new materials, such as availability, economics, techniques for selection, fabrication technology, and design practices. Based on an evaluation of the influence of these factors, measures are recommended that could be taken to encourage the prompt utilization of new materials and processes in newly designed systems in which they would provide advantage.

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PROCEEDINGS OF THE SYMPOSIUM ON POTENTIAL APPLICATION OF REMOTE SENSING TO ECONOMIC DEVELOPMENT IN DEVELOPING COUNTRIES

Smithsonian Institute. 1970. 152 pages.

PB–203 310

Proceedings are reported of a symposium hosted by the Smithsonian Institution in November 1970 on remote sensing of earth resources and conditions by aerospace and remote technology, with especial application to economic betterment in developing countries. Airplane surveys of topography and land use, mineral and marine resources, agricultural and surface water zones, arid lands, forests, oceanography, environmental pollution, and geological hazards were discussed, leading to the possibilities for satellite coverage of urban and rural areas. Themes of the several sessions included the consideration of economic factors and cost effectiveness, the extent to which acquired survey information has been used, determination of fields of emphasis, decision making on whether monitoring is needed in a particular locale, commercially available sensing and data processing systems, the direction recommended for optimum effectiveness in United States research, and the effectiveness of institutional, organizational, and technical programs.

REPORT OF THE INDO-U.S. WORKSHOP ON THE MANAGEMENT AND ORGANIZATION OF INDUSTRIAL RESEARCH HELD AT BARODA FROM MARCH 2–6, 1970

National Institute of Sciences of India. 1970. 59 pages.

PB–203 311

The document reports a seminar on applied industrial research attended by personnel from India and the United States, held in Baroda, India, in March 1970. Of primary concern were the functions and directions of industrial research and development programs. Topics of main interest included the role of leadership and management in establishing policies and objectives, as well as the form which policies and objectives should take in the time frame involved, along with optimal procedures for review and revision. Discussions included choices between attainable and unattainable goals, utilization of new operations and methodologies, the increase in effectiveness of research personal and of performance evaluation, and the value and need for periodic efficiency reports.

THE FUTURE OF U.S. TECHNICAL COOPERATION WITH KOREA

National Academy of Sciences. November 1969. 57 pages.

PB–203 325

A study was made to determine needs and problems which the Republic of Korea has and will continue to have, and why the United States should give technical assistance to Korea. This report presents the following information: The identification of the needs for technical assistance during the 1970's and beyond; the foreign and local costs implied by these needs; the types of systems which might be established to achieve the identified technical assistance; how an administrative institution could be developed, financed, and coordinated with appropriate U.S. federal agencies, and nongovernment institutions; and how support for the recommendations might be generated.

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EAST PAKISTAN LAND AND WATER DEVELOPMENT AS RELATED TO AGRICULTURE

National Academy of Sciences. January 1971. 74 pages.

PB–203 328

A panel of scientists has investigated problems of East Pakistan and has reviewed proposals of the International Bank for Reconstruction and Development for an action program to assist East Pakistan in agriculture. Some of the problem areas considered include: food programs; research; water control, management, and development; training; and facilities and services for improved agriculture. The panel's comments and recommendations are summarized in this report.

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RESEARCH PRIORITIES AND PROBLEMS IN THE EXECUTION OF RESEARCH IN GHANA. PART I SUMMARY. PROCEEDINGS OF THE WORKSHOP ON SCIENTIFIC RESEARCH HELD AT ACCRA, JANUARY 18–22, 1971

National Academy of Sciences. January 1971. 77 pages.

PB–203 329

Ghana, a West African land with a history dating back to the 4th century A.D., is now emphasizing a program of economic and industrial betterment incident to a developing country. In line with the program a workshop in national research was held in Accra in January 1971, with interested United States personnel in attendance. The main focus was on problems and priorities involved in the effort. Reports were given on a wide range of subjects under the heads of agricultural and biological studies, physical and technological programs, and mobilization of human and material resources. Reference was made also to similar work in other parts of the world. The document, a summary, is volume 1 of a two-volume report.

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SCIENTIFIC RESEARCH IN GHANA. PART 2. FULL REPORT. PROCEEDINGS OF THE WORKSHOP ON RESEARCH PRIORITIES AND PROBLEMS IN THE EXECUTION OF RESEARCH IN GHANA HELD IN ACCRA JANUARY 18–22, 1971

National Academy of Sciences. Ammishaddai Adu. 1971. 320 pages.

PB–203 330

The document reports on a workshop held to deal with the priorities and problems of a developing country: Ghana in West Africa. It is the second volume of a two volume work, covering details of the workshop including introductory and keynote addresses, and transcripts of the reports presented with the discussions which followed each; volume 1 is a summary of the same material. Reports were made on agricultural and economic development, biological research in relation to national development, types of problems met in program execution, research efforts and problems encountered in the physical and technological sciences, and the mobilization of human and natural resources. Further consideration was given to matters previously discussed in the fields of nutrition, public health, forestry, and education. All the discussions centered around the determination of priorities. An additional report concerned soil research in China.

* * *

THE ROLE OF SCIENCE AND TECHNOLOGY IN PERUVIAN ECONOMIC DEVELOPMENT

National Academy of Sciences. 1966. 95 pages.

PB–203 362–U

Peru, as a developing country seeking advancement in economic position and technological capability, is mobilizing resources. The document reports on a workshop held in Paracas in April 1966, aimed at gaining new perspective and technical philosophy. Reports presented and staff notes made are included on technical training and research, physical and human resource utilization, scientific and technical organizations, and planning-decision making. An analysis is made of industrial productivity and possibilities; international factors are noted. Special attention was devoted in the workshop to manpower needs and the establishment of priorities.

* * *

SECOND PERU-UNITED STATES WORKSHOP ON SCIENCE AND TECHNOLOGY IN ECONOMIC DEVELOPMENT. VOLUME I

National Academy of Sciences. 1967. 74 pages.

PB–203 363–U

The document is volume 1 of a two–volume report on a Peru-United States workshop on the socio-economic-technical advancement of a developing country. It contains summaries of the reports presented, along with recommendations agreed upon by a bilateral panel. Among the main topics discussed were optimal organization in scientific and technological research, the function of science in secondary education, governmental and industrial responsibility for national research, and specific needs for professional manpower. The recommendations formulated dealt with higher education, research responsibility, and human resource utilization, as well as a continued United States-Peru cooperation.

◆

SECOND PERU-UNITED STATES WORKSHOP ON SCIENCE AND TECHNOLOGY IN ECONOMIC DEVELOPMENT. VOLUME II

National Academy of Sciences. 1967. 313 pages.

PB–203 364–U

The document is volume 2 of a two-volume report on a Peru-United States workshop on the socio-economic-technical advancement of a developing country. It contains transcripts in both English and Spanish of the contributed papers on organization, research, and manpower. Individual topics included secondary education, science in higher education, responsibilities of industry and government in research, armed forces research, evaluation of resources, agricultural, forestry, and marine science research, public health, human resources, and training programs for Peruvian scientists.

◆

SCIENCE AND BRAZILIAN DEVELOPMENT

National Academy of Sciences. 1968. 125 pages.

PB–203 366–U

A report is made of the issues discussed and the conclusions reached at the second United States-Brazil workshop on industrial research and technology utilization held in Washington, D.C. in February 1968. Data are taken from papers presented and staff notes collected on pertinent phases of Brazilian economic development. The discussions were all centered on the principal objective of improving agricultural research in Brazil, with the view of formulating recommendations and determining priority areas which may receive attention from national, bilateral, and international technical assistance programs. Main topics covered were applications of nuclear engineering, industrial research, mineral resource investigations, tests and measurements, technological problems solving, and national and specific goals in agriculture, geology, physics and chemistry, biology, and medical sciences. Question and answer sessions were also included.

◆

INDUSTRIAL RESEARCH AS A FACTOR IN ECONOMIC DEVELOPMENT. REPORT OF THE JOINT STUDY GROUP ON INDUSTRIAL RESEARCH. U.S.-BRAZIL SCIENCE CO-OPERATION PROGRAM

National Academy of Sciences. September 1968. 39 pages.

PB–203 373–U

It is felt that the wise use of industrial research could be a decisive factor in reaching and maintaining a high level of economic development in Brazil. For this development it is important that Brazilian industry make use of the best of the world's stock of technology. In recognition of this need, a Joint Study Group on Industrial Research was organized under the auspices of the National Research Council of Brazil and the National Academy of Sciences (U.S.A.). This report summarizes the discussions and recommendations resulting from four meetings of the Joint Study Group which were held between April 1967 and July 1968. Topics include research expenditures, financing, fiscal incentives, research management, research personnel training and management, research institutes, information and documentation services, and patents.

◆

COLOMBIA-U.S. WORKSHOP ON SCIENCE AND TECHNOLOGY IN DEVELOPMENT. VOLUME I

National Academy of Sciences. 1968. 67 pages.

PB–203 374–U

The type of outside technical assistance which can be rendered by the Agency for International Development (AID) is being sought in various developing countries of the world. The document, Volume 1 of a two-volume report, covers a workshop on scientific and technological advancement which was called in Fusagasuga, Colombia, in February 1968 by Colombian governmental and industrial leaders, and in which United States and Colombian representatives cooperated. The report records discussions and conclusions on the topics of agriculture, education, natural resources, industrial problems, research development, and policy making. Staff notes and recommendations formulated are also included.

◆

COLOMBIA-U.S. WORKSHOP ON SCIENCE AND TECHNOLOGY DEVELOPMENT. VOLUME II

National Academy of Sciences. 1968. 102 pages.

PB–203 375–U

In line with the current encouragement of outside assistance by developing countries in advancing their economic status and utilizing their resources, industrial and government leaders in Colombia scheduled a workshop on science and technology in

Fusagasuga, Colombia, in February 1968, which was attended by United States and Colombia representatives in cooperative effort. The document, Volume 2 of a two-volume report, contains transcripts of the papers presented. Topics covered were overall policy determination, educational research direction, agricultural and livestock problems, non-renewable resources, university program benefits, industrial research difficulties, and the establishment of research institutes. Considerable detailed and statistical analysis was included.

◆

PHILIPPINES-U.S. WORKSHOP ON INDUSTRIAL RESEARCH. PART I

National Academy of Sciences. 1969. 36 pages.

PB–203 376–U

PHILIPPINES-U.S. WORKSHOP ON INDUSTRIAL RESEARCH. PART II

National Academy of Sciences. 1969. 129 pages.

PB–203 377–U

In 1968 the Special Science Fund Act was signed into law by the President of the Philippines. The law provided approximately 40 million pesos over a five-year period for the support of scientific pursuits and research in the country. As part of an effort to maximize the potential effect of the fund on national development, the National Science Development Board, which is the Fund's implementing body, organized a Workshop on Industrial Research. The workshop, which was held in Baguio City, Philippines, 26 January-1 February 1969, had as its objectives: To stress relationships between economic development and industrial research; to review the status of industrial research in the Philippines; to identify gaps and requirements; and to develop guidelines and general policies in the development of industrial research. Part I summarizes the views and recommendations of the workshop participants. Part II is comprised of the working papers presented by the participants.

◆

SCIENCE AND NIGERIAN DEVELOPMENT: REPORT OF A WORKSHOP

National Academy of Sciences. 1965. 122 pages.

PB–203 390–U

In response to the requests of a group of Nigerian scientists for guidance in organizing an academy of sciences in Nigeria, a workshop was held in Bellagio, Italy, in August 1965, attended by scientists, government leaders, and members of national boards in Nigeria and the United States, including the U.S. Agency for International Development (AID). One of the chief aims of the workshop was to determine optimum scientific policy in a developing country. The document reports on the discussions which were divided into eight sessions, including the division of labor between universities and research institutes, the development of scientific personnel by education and training, the relation of public health to economic development, utilization of natural resources, agricultural planning and research, the setting of priorities in international cooperation, and the value of science academies and research organizations to the economy.

* * *

PHILIPPINES-U.S. WORKSHOP ON SCIENTIFIC AND TECHNOLOGICAL COOPERATION AND DEVELOPMENT. PART I

National Academy of Sciences-National Research Council. 1965. 14 pages.

PB–203 394–U

SCIENCE AND PHILIPPINE DEVELOPMENT. REPORT OF A WORKSHOP ON SCIENTIFIC AND TECHNOLOGICAL COOPERATION AND DEVELOPMENT. PART II

National Academy of Sciences-National Research Council. 1965. 250 pages.

PB–203 395–U

A workshop was held in Manila, Philippines, November 22–26, 1965, for the purpose of determining: (1) the extent to which the Philippine Government utilizes science and technology for economic development; and (2) whether a program of cooperation for science development between the National Academy of Sciences-National Research Council and the National Science Development Board (and other Philippine institutions) is desirable. Part I provides a list of participants and summarizes the findings of the workshop. Part II contains the papers presented at the workshop and other relevant materials.

* * *

SCIENCE AND BRAZILIAN DEVELOPMENT: REPORT OF A WORKSHOP ON CONTRIBUTION OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

National Academy of Sciences. 1966. 49 pages.

PB–203 413–U

The document reports on a workshop held in Atatiaia, Brazil, in April 1966 by the Brazilian National Research Council and the U.S. National Academy of Sciences-National Research Council, in cooperation with the Agency for International Development (AID) as part of a program aimed for the economic advancement of a developing country. Transcripts of the papers which were presented by participants and the notes that were made by the staff are given. The topics covered include agriculture, public health, assistance to industry, mineral resources, geographic integration of communication and transportation, and the development of scientific and technological manpower. Formulated recommendations are included.

* * *

STABILIZED BALLAST INVESTIGATION

Association of American Railroads. G. M. Magee. August 1969. 89 pages.

PB–192 720

The ballast or rock foundation for ties underlying railroad tracks may be subject to deflections which induce unequal tie settling and eventually lead to rough riding. One method for improving performance in roadbed ballast is the introduction of elastomer emulsions into the ballast. Stabilization tests and the results obtained in a program using butadiene styrene block polymer are discussed. A description is given of loading data, instrumentation, settlement measurements, and pressure investigations of treated and untreated ballast in full scale tests of railroad tracks. Much of the data appears in graphic form.

* * *

Transportation

CHOICE OF TRANSPORT TECHNOLOGY UNDER VARYING FACTOR ENDOWMENTS IN LESS DEVELOPED COUNTRIES

Charles River Associates Incorporated. June 1970. 409 pages.

PB–195 291

Management of any transport system technology can be complicated by the relationships existing between the system and economic processes such as production and distribution interactions and the sale of individual commodities or services. Information is therefore needed which can assist developing countries in choosing effective transport methodologies. A mathematical model is often useful in this regard. The study develops a simulation model for cost analysis of road, rail, and air transport modes, considering the availability of labor, capital, and resources in the planning process. The part played by investment decisions is related to this process. Project analysis, leading to the selection of most favorable project designs from a multitude of possibilities, is discussed as a valuable tool that can investigate such factors as leadership and attitudes, government functions, economic and nonmonetary influences, the role of pricing, and the consideration of tradeoffs. Topic heads include national economics and geography, mode vs mode, transport link performance, commodity costs, model construction—particularly for the air mode, and prices.

* * *

STUDY AND FORECAST OF FREIGHT CAR MANAGEMENT SYSTEMS

Alton Associates Corporation. April 1971. 148 pages.

PB-199 804

The study examines, describes and evaluates nine computerized railroad management and control systems, ranging from sophisticated management information systems with the capabilities to forecast supply and demand of empty cars and control and monitor car movements, down to basic message switching systems which provide only limited historical car movement information. These systems are comparatively evaluated in terms of their compatibility to meet the operational and management needs of traffic interchange. The communications, information and data systems (hardware and software) used in railroad freight car management systems are related to their use, and an assessment of their compatibility with other management objectives is made. The probable technological development trends in communication, information, and computer systems expected in the next ten years are identified, analyzed and summarized. The trends in the railroad industry are discussed and related to the needs for standardization and management.

* * *

TUNNELING COST ANALYSIS

Research Management Corporation, Incorporated. Louis A. Spittel, and James C. Willyard. March 1971. 160 pages.

PB-201 363

In a move to offset the escalation of labor costs in ground transportation systems, planners have turned to the utilization of cost analysis. The report contains data which were obtained from tunnel owners, contractors, and equipment and material manufacturers throughout the United States on tunnel design and specifications, geologic formations, contract management, crew size, time estimates for operations, and machinery. Methods of acquiring, processing, and analyzing the data are discussed. Included is a brief review of the cost impact of differences in policy and tunnel design.

* * *

Water Supplies

WATER: PURIFICATION AND DECONTAMINATION

Defense Documentation Center. June 1971. 99 pages.

AD-725 610

Summaries are provided of U.S. Government funded research reports, covering the period 1953-1970, which deal with water treatment for water supply protection and for potability. The subjects covered include processes and methodologies for spore and organism destruction, germicide effectiveness, colloid filtration, decontamination from chemical warfare actions, ground water purification, algae and bird product control, utilization of permafrost and arctic ice, waste water and sea water recovery, and industrial waste removal. Other topics covered are space flight and survival shelter recycling systems, demineralization, storage methods, sterilization procedures, detection of trace amounts of organic contaminants, protection of human teeth, radiological contamination assessment and tolerances, color improvement, and cost factors. The reports listed are available from NTIS.

◆

SMALL WELLS MANUAL: A MANUAL OF LOCATION, DESIGN, CONSTRUCTION, USE AND MAINTENANCE

Minnesota University. Ulric P. Gibson, and Rexford D. Singer. September 1969. 163 pages.

PB–190 672

Water well characteristics are of major concern in rural areas where lack of information can lead to debilitating or incapacitating disease. The document contains data on the location, construction, and maintenance of small diameter, relatively shallow water wells, aimed principally at persons who have little or no experience in the subject. Topics covered are the relation of ground water to public health, water conservation measures, the ground water cycle, geologic formations as aquifiers or water bearing strata, ground water flow and hydraulics, water well design considerations, proper well construction on protection measures, pumping equipment, and pollution control. Site selection is related to drainage.

◆

DEVELOPMENT AND EVALUATION OF WATER HARVESTING SYSTEMS

Arizona Water Resources Research Center. Carwin B. Cluff, Gordon R. Dutt, Martin M. Fogel, and Lorne G. Wilson. December 1969. 29 pages.

PB–192 763

The methodology employed in semi-arid country to collect and retain natural rainfall for water supply is known as water harvesting. Various systems using a paved catchment and a storage basin are in current use in many dry areas, although the short term life and the high expense of these catchments are shortcomings. The document describes research aimed at overcoming these deficiencies by developing a gravel covered plastic catchment and a polyethylene storage tank with a butyl rubber cover. A description is given of the procedures used to spread the catchment material and install the reservoir. A second technique is discussed in which water supplies are retained underground by sodium chloride treatment of the soil, preventing water absorption and allowing the water to be retained for return to the surface by evapotranspiration.

◆

SYNTHETIC RUBBER CANAL LINING

Bureau of Reclamation, Engineering and Research Center. M. E. Hickey. April 1971. 43 pages.

PB-200 553

Available from industry today are a number of synthetic rubber materials that are especially compounded as waterproofing membranes. Laboratory and field investigation have now demonstrated that two of these materials, butyl and ethylene propylene diene monomer (EPDM) sheeting, can be successfully employed as both buried and exposed linings for canals and reservoirs. The document summarizes the results of these investigations, and provides general information relative to methods of installation and costs of such membranes.

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APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT

Agency for International Development
Office of Science and Technology
Washington, D.C. 20523

April 1972

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INTRODUCTION

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Prices of the reports, listed by order number, appear on page 117.

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OXIDATION ROASTING OF CHALCOCITE CONCENTRATE

Bureau of Mines. M. M. Fine, A. B. Landstrom, and R. B. Schluter. 1970. 23 pages.

PB–190 030

The copper industry makes widespread use of a matte-smelting process which has remained relatively unchanged since it became universal practice 50 or 60 years ago. Research work is now underway to uncover a cleaner, more direct pyrometallurgical process for winnowing copper from sulfide ores. As a first step, roasting experiments were conducted on chalcocite concentrates (26–34% Cu and 6–7% S). The method involved pelletizing the concentrates and roasting them in air in either a rotary kiln or a fluid-bed reactor. Both techniques were capable of producing copper calcines containing less than 1% residual sulfur. The calcined pellets were strong, porous, and readily reducible.

ELECTROLYTIC PREPARATION OF TUNGSTEN METAL AND TUNGSTEN CARBIDE FROM WOLFRAMITE

Bureau of Mines. John M. Games, Kenji Uchida, and M. M. Wong. February 1970. 12 pages.

PB–190 035

The electrolytic method for recovery of tungsten or tungsten carbide from wolframite would eliminate several steps from the conventional procedures for preparing these products. The conventional procedures include ore decomposition, preparation and purification of intermediate tungstates or tungstic acid, reduction of oxide to metal, and carburization of metal to carbide. Two methods for electrowinning tungsten from wolframite [$(Fe, Mn)WO_4$] are described. The first method, direct electrowinning from wolframite concentrate dissolved in molten salt mixtures composed essentially of various combinations of sodium phosphates, sodium borates, and sodium halides, yielded impure products. The second method was electrowinning from a halide-tungstate melt that was obtained from a high-temperature, two-phase extraction of tungstic oxide (WO_3) from wolframite. Eletrolysis in electrolytes prepared from addition of sodium metaphosphate ($NaPO_3$) and boric oxide (B_2O_3) to the halide-tungstate melt produced tungsten metal of 99.9 percent purity. Tungsten carbide (WC) was electrodeposited from the halide-tungstate melt.

ELECTROWINNING ALUMINUM FROM ALUMINUM CHLORIDE: OPERATION OF A SINGLE-COMPARTMENT CELL

Bureau of Mines. D. E. Kirby, E. L. Singleton, and T. A. Sullivan. March 1970. 28 pages.

PB–190 771

The preparation of aluminum by molten salt electrolysis of $AlCl_3$ was undertaken to develop methods for the utilization of low-grade raw materials. There are several potential advantages for the production of aluminum from $AlCl_3$ rather that from Al_2O_3 in a fluoride system. A lower operating temperature, 700 to 750 C, should lower energy requirements. The electrolyte is less corrosive and coupled with lower temperature operation, promotes longer cell life and increases the variety of suitable cell construction materials. A broader operating range of aluminum concentration is possible with aluminum chloride in a chloride electrolyte than with alumina in a fluoride electrolyte. In the reported research, an externally heated, single-compartment cell with a rammed refractory lining was used with molten $KCl\text{-}NaCl\text{-}AlCl_3$ electrolyte. Aluminum was deposited with a current of 100 to 200 amperes on a molten aluminum cathode. Aluminum of a purity equal to or better than 1100 series metal was electrowon continuously from commercial $AlCl_3$ for a period of 4½ months.

CONTINUOUS HEAVY LIQUID CONCENTRATION OF SPODUMENE

Bureau of Mines. R. B. Tippin, James S. Browning, and Thomas O. Llewellyn. May 1970. 29 pages.

PB–192 030

Research is underway to develop or improve methods of utilizing mineral resources. One such method, heavy liquid separation (HLS), has long been a recognized laboratory technique to separate minerals but only in recent years has this method been considered as a continuous process. The best prospects appear to be the direct concentration of minerals to yield marketable products or preconcentration of ores ahead of a final separation. Heavy liquid separation is a gravity concentration method based on the simple principle that a material whose specific gravity is less than the liquid's will float and a material with a greater gravity will sink. The primary reasons that organic heavy liquids have not been used commercially are that they are expensive and a fully effective or cheap method for their recovery from mineral particles has not heretofore been developed. To study continuous operation of the heavy liquid separation (HLS) of minerals, spodumene was concentrated from a typical ore using tetrabromomethane (TBE). The studies included heavy liquid concentration, removal of the heavy liquid from the mineral products, and recovery of the heavy liquid for reuse. The research program examined the influence of feed moisture, steam consumption, stripping time, and condition of steam. Operation of multiple cyclones in series resulted in spodumene concentrates assaying 92 to 95 percent spodumene and indicated mineral recoveries of 86 to 89 percent. Continuous filtration and steam stripping produced mineral products containing less than 1 pound of heavy liquid (TBE) per ton of material. Problems unique to this process are discussed, including heavy liquid properties and viscosity, toxicity, material handling hazards, and safety precautions.

BATCH REDUCTION OF IRON ORE IN FLUIDIZED BED

Bureau of Mines. John P. Hansen, J. E. Berryhill, and J. A. Aufman. December 1970. 29 pages.

PB–196 688

The steel industry is presently developing processes for the production of high quality blast furnace feed. Of special interest has been the reduction of iron oxide to metal in fluidized beds with carbon monoxide, or a mixture of the two from commercial fuels. In order to elucidate some of the variables involved in the process, and investigation was made of the reduction of red and brown iron ore concentrates by gaseous reductants in a fluidized bed reactor. Data were gathered on the effects of temperature, gas consumption, and gas flow rates. The findings include the following: 1) Below 725C, the rate of reduction is controlled by the reaction at the reduction interface; 2) above 725C, the rate of reduction is directly proportional to the reactant gas flow rate; 3) above 725C, H2 reduced iron ore much faster than CO; 4) large concentrations of CO in mixtures have a serious inhibiting effect on the reduction rate.

MALONONITRILE EXTRACTION OF GOLD FROM ORES

Bureau of Mines. Harold J. Heinen, J. A. Eilsele, and B. J. Scheiner. December 1970. 15 pages.

PB–196 691

Conventional cyanide extraction of gold is hindered when the gold is in a low-grade refractory carbonaceous ore in which the organic matter is finely disseminated in a clay matrix. An approach to this problem is a more effective gold leachant. Malononitrile was evaluated and compared with sodium cyanide as an extractant for gold from this type of ore. Methods for recovering gold from the resulting pregnant solutions and the effect of ion-exchange resin on gold recovery from carbonaceous ore pulps were also investigated. The malononitrile increased the gold recovery 10 to 20 percent, while the addition of an anion-exchange resin to the malononitrile-containing ore pulp increased the gold recovery 67 to 95 percent.

METALLURGICAL APPLICATION OF SOLVENT EXTRACTION. 1. FUNDAMENTALS OF THE PROCESS

Bureau of Mines. D. W. Bridges, and J. B. Rosenbaum. 1962. 50 pages.

PB–197 878

METALLURGICAL APPLICATION OF SOLVENT EXTRACTION. 2. PRACTICE AND TRENDS

Bureau of Mines. J. B. Rosenbaum, D. R. George, and Joan T. May. January 1971. 23 pages.

PB–198 134

Solvent extraction has become important as a unit process in extractive metallurgy due to its flexibility and simplicity. The first of two reports deals with the status of solvent extraction in metallurgy, as well as with the rudiments and terminology of the unit operation. The second report reviews the status of solvent extraction in industrial practice and summarizes the chemistry of typical systems.

CONTINUOUS HEAVY LIQUID CONCENTRATION OF KYANITE

Bureau of Mines. Thomas O. Llewellyn and James S. Browning. March 1971. 15 pages.

PB–198 285

Kyanite and mullite (converted kyanite) are principally used by the glass and metallurgical industries, and to a minor extent mullite is used by the ceramic, chemical, and electrical industries. Heavy liquid had been used for a long time as a laboratory tool in studying the separation of mineral mixtures. Previous tests on this kyanite ore revealed that it was suited for heavy liquid cyclone beneficiation using pure tetrabromoethane. The purpose of the investigation was to produce a high-grade kyanite concentrate by heavy liquid cyclone separation and to continue the study of tetrabromoethane removal from cyclone products by steam stripping, detergent scrubbing, and a combination steam stripping-detergent scrubbing. Use of a three-stage heavy liquid cyclone circuit demonstrated that a 96.4- to 99.0-percent kyanite concentrate could be obtained with recoveries of 95.5 to 96.7 percent. The test work also showed that by steam stripping with 6.9 tons of steam per ton of ore and two stages of detergent scrubbing the residual tetrabromomethane content of kyanite cyclone products was 0.22 pound per ton of ore.

PROCESSES FOR EXTRACTING ALUMINA FROM NONBAUXITE ORES

Nation Materials Advisory Board. December 1970. 103 pages.

PB–198 507

The most promising sources of supply for alumina (other than commercial bauxite) were reviewed, basic approaches to the processing of clay and other sources were examined, and the most workable processes were appraised. An acid process for the treatment of clay appeared the most promising for the economic production of alumina from materials other than commercial bauxite. Available experimental and pilot plant data indicated that these processes normally were not competitive with acid processes. The technical feasibility of producing near reduction-grade alumina by the hydrochloric acid extraction from clay has been demonstrated on a small scale.

PRODUCTION OF HIGH-PURITY SYNTHETIC RUTILE FROM A DOMESTIC ILMENITE CONCENTRATE

Bureau of Mines. Gerald W. Elger, and W. A. Stickney. August 1971. 10 pages.

PB–203 891

Manufacture of titania pigment is accomplished using either the sulfate process in which the ore is reacted with concentrated sulfuric acid, or the chloride process in which the ore is chlorinated to form titanium tetrachloride which is then reoxidized to form pigments. Rutile is the feed of choice in the chloride process because of its low impurity content and high titanium dioxide content. Ilmenite is unsatisfactory for use in the chloride process because iron and other impurities are also chlorinated, resulting in high chlorine usage and severe waste disposal problems. For areas having abundant reserves of ilmenite it would be advantageous to be able to produce titania from ilmenite. Because of this fact, a new process for producing synthetic rutile from ilmenite is described. Rutile formation is based on oxidation and fluxing of titania slag produced by electric furnacing of ilmenite. Laboratory tests show that phosphorus pentoxide flux additions to oxidized slag enhance conversion to rutile by forming a phosphate-based glass matrix. In several instances, more than 90 percent of the titanium in the slag was recovered to yield combined rutile fractions containing 90.2 to 92.6 percent titania.

Chemical Analysis

SPECTROPHOTOMERIC DETERMINATION OF SULFATE IN CHROME PLATING BATHS

Frankfort Arsenal. Quality Assurance Directorate. G. Norwitz. June 1971. 22 pages.

AD–729 336

Sulfate in chrome plating baths is usually determined by methods depending upon precipitation of barium sulfate. This method, however, often is difficult or inaccurate due to impurities. An accurate, rapid spectrophotometric method is described for the determination of sulfate in chrome plating baths. An aliquot of the bath is treated with a mixture of hydriodic, hypophosphorous, and hydrochloric acids in a special distillation apparatus while passing nitrogen through the system. The hydrogen sulfide which results from the reduction of the sulfate is absorbed into ammonium hydroxide, lead citrate is added, and the yellowish-brown lead sulfide color is measured.

———o———

IDENTIFICATION OF ELASTOMERS BY PYROLYSIS-GAS CHROMATOGRAPHY

Naval Avionics Facility. James E. Coakley, Hugh H. Berry. August 1971. 19 pages.

AD–730 470

The rapid chemical analysis of high melting materials such as polymers can be quite difficult. The report describes a pyrolysis-gas chromatographic method for the routine identification of elastomeric materials. Elastomers previously identified by pyrolysis-infrared spectrophotometry were pyrolyzed in the injection port of a gas chromatograph. Reproducible pyrograms were obtained. A pyrogram catalog of commercially important elastomers was compiled to be used as a reference for identifying these materials. As a further aid in identification, the retention times of the major pyrolysis product-peaks were recorded with the aid of a digital integrator.

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Desalination

WATER: DESALINATION

Defense Documentation Center. June 1971. 60 pages.

AD–725 600

The bibliography is comprised of summaries of U.S. Government funded reports on water desalination. The reports include information on providing fresh water from the sea by means of solar energy, evaporators, distilling plants, and vacuum apparatus. The reports listed are available from NTIS.

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TITLE-AUTHOR-COMPANY INDEX TO REPORTS PUBLISHED BY THE U.S. DEPARTMENT OF THE INTERIOR, OFFICE OF SALINE WATER

Oak Ridge National Laboratory. K. O. Johnsson. November 1970. 84 pages.

ORNL–NDIC–8

A major portion of water desalination research in the United States is done under the sponsorship of the Office of Saline Water. As of July 1970 over 575 reports had been generated as a result of the research. This document presents a word-by-word alphabetical index of these reports prepared with the aid of a computer from their titles, authors, and associated report numbers. The reports listed have either been published in technical journals, or are available for sale from the U.S. Government Printing Office and NTIS.

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BUDGETARY CAPITAL COST ESTIMATES OF 1– TO 10–MGD MULTISTAGE FLASH DISTILLATION PLANTS FOR DESALTING SEAWATER

Oak Ridge National Lab. R. A. Greene, S. J. Senatore, and R. A. Ebel. August 1970. 44 pages.

PB–193 689

By means of a computer program, capital costs were estimated for several multistage flash (MSF) desalting plants in the 1–10–Mgd size range. The report tabulates changes in capital cost estimates as a result of variations in performance ratio, tubing price, copper-nickel vs titanium tubing, flow velocity in tubes, number of vessels in the plant, number of stages, and seawater feed temperature. For all capital cost summaries, the tabulations show a breakdown into the following categories: seawater intake, sitework, buildings, evaporator, shell, pumps and motors, valves and piping, chemical systems, instruments, electrical, deaerator, brine heater, and indirect costs.

INTAKE SYSTEMS FOR DESALTING PLANTS

Dow Chemical Company. B. P. Shepard, P. G. LeGros, J. C. Williams, Dorothea C. Mangum, and F. W. McIlhenny. April 1971. 256 pages.

PB–202 767

The ocean constitutes, by far, the largest source of feed water for desalination plants as well as for process and industrial uses. What appears to be a simple process—supplying water to the plant—is one of the leading causes of seawater desalination plant shutdown. Failure to observe and incorporate in the design some of the basic engineering principles affecting seawater intake systems has, many times, been the reason for the failures. A study has been made of the particular engineering aspects of seawater intake systems for desalination plants, and this report presents them in such a way that they can be used to supplement standard engineering principles so that seawater intake systems can be built economically and operate dependably.

MULTISTAGE FLASH DISTILLATION DESALTING STATE-OF-THE-ART

Hittman Associates, Incorporated. October 1969. 151 pages.

PB–203 125

The multistage flash (MSF) desalting process has been successfully utilized since the 1950's. There are a large number of MSF plants with capacities of 1.0 million gallons/day or greater currently in operation or being planned. This report presents a review of the current state of MSF design and economics. The specific areas of coverage include: A description of MSF flow processes and process calculational methods; a discussion of process design parameters; MSF plant capital cost, including the portion of the cost attributed to the major components; total water cost, including a discussion of the elements of cost; single and dual purpose plant costing methods; a discussion of potential future developments and cost reduction. In addition, a group of nomographs is included which allows evaluation of MSF plant processes and economic parameters.

VACUUM FREEZING VAPOR COMPRESSION DESALTING STATE-OF-THE-ART

Hittman Associates, Incorporated. October 1969. 65 pages.

PB–203 126

The separation of fresh water from saline solutions by freezing is based on the fact that ice crystals which form when the saline solution is cooled are essentially salt free. All freezing processes involve forming of ice crystals, segregating of the ice crystals from the saline solution, and melting of the ice crystals. In the vacuum freezing-vapor compression (VFVC) desalination process, salt water is introduced into a vacuum where part of it freezes and part vaporizes. The vapor and ice crystals are then separated from the remaining brine to produce potable water. The report presents a state-of-the-art review of the VFVC process. The report provides an evaluation and analysis of the process theory, design, and economic cost variables. Additionally, potential developmental areas are reviewed and examined. It is concluded that the VFVC process is a viable process for the desalting of both seawater and brackish water feeds. The process has been extensively demonstrated in pilot plant operation to be capable of reliable operation on a variety of feedwater compositions. Chemical treatment to preclude scale formation has not been required.

AN ECONOMIC AND ENGINEERING ANALYSIS OF THE ELECTRODIALYSIS PROCESS

Bechtel Corporation. J. Winston Porter, and S. Clerney. August 1969. 192 pages.

PB–203 280

One of the major processes for demineralizing brackish water is electrodialysis. In this process, membranes which have been chemically prepared to exclude either positive salt ions (cations) or negative salt ions (anions) are usedin alternating fashions in a stack. When a voltage is imposed across the stack, alternate compartments are enriched or depleted in salt ions. Thus, a waste brine stream and a fresh water product stream are produced. In the study a parametric economic and engineering evaluation of the electrodialysis process was carried out. In order to assist in the process and economic analyses involved, a computer algorithm was developed. This computer program performs necessary process and plant design calculations in order to provide capital and water costs for each plant. Also presented as a discussion on the following: The effect of power cost and feedwater temperature on desalted water costs; an analysis of critical components and their effect on desalted water costs; and the effect on desalted water costs of certain "projected" technology items, including decrease in membrane cost and resistance, and an increase in the allowable operating current density.

DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS: REVIEW AND BIBLIOGRAPHY

Bureau of Reclamation. G. W. Depuy. July 1969. 211 pages.

PB–203 835

The production of fresh water from saline water leaves the matter of what to do with the waste effluents, having little obvious use or value, largely unanswered. Solutions to the waste brine problem revolve about two alternatives: ultimate disposal or dumping, or recovery and utilization. The heart of the brine disposal problem lies in the extremely large volumes of waste brine produced by the desalting process, and the costs of disposal. Disposal costs contribute significantly to the price of producing water. The report reviews the use of evaporation as a brine disposal method and concentrates on the following areas: Solar evaporation ponds, evaporation, evaporation pond seepage, and evaporation pond linings. The bibliography contains 870 references. References are indexed and cross referenced according to 18 subject areas.

Inorganic Chemicals

CARBORANE POLYMERS

Chemical Systems Incorporated. Robert E. Williams. August 1971. 31 pages.

AD–732 031

At present the most promising use for the various carboranes lies in incorporating them into polymers with the objective of building into the polymers special properties such as high temperatures resistance and/or specialized chemical resistance. To date investigators have successfully incorporated carboranes both into the backbone of most of the common types of addition and condensation polymers and also in many cases as pendant groups or side chains. The carboranes, when incorporated into the backbone of silicone polymers, show especially interesting properties. The Dexsil polymers based upon $C_2B_{10}H_{12}$ are prime examples, and soon similar materials based upon the closo-carborane $C_2B_5H_7$ will be available. Part of the report reviews in a cursory fashion examples of the numerous types of carborane-polymers which have been prepared and thus serve as the background upon which the more recent polymer progress has been achieved. Secondly, the budding field of $C_2B_5H_7$ based polymers are covered. They are just now moving out of laboratory curiosity status and into commercial availability.

A NOVEL ZEOLITE CATALYST

Texas A and M University. 1969. 6 pages.

PB–190 116

Since molecular sieve catalysts were first introduced they have found widespread use in major refining and petrochemical applications. The most dramatic impact of zeolite catalysts in commercial applications has occurred in the catalytic cracking industry. Catalytic cracking requires a very acidic catalyst. Since zeolites in the sodium form are only weakly acidic, some alternation is required to increase the acidic character. A novel technique has been developed for producing an active catalyst. The technique involves ion exchanging a NaY zeolite in a solution which is approximately 0.13 M in $Al(NO_3)_3$. The catalytic activity of this material was tested in a microcatalytic reactor using the cracking of 2, 3-dimethylbutane and the cracking of toluene to determine the level of activity.

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NITROGEN OXIDES: AN ANNOTATED BIBLIOGRAPHY

National Air Pollution Control Administration. August 1970. 636 pages.

PB–194 429

The primary objective of the publication is to collect, condense and organize existing literature on the nitrogen oxides. The 1500 abstracts deal with basic information concerning atmospheric, chemical, physical, and biological properties of this family of compounds. Most of the documents are from recent literature (1959–1970) with some being from the early part of the century. Subject, author, and geographic indexes are included.

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TRENDS IN USAGE OF ANTIMONY

National Materials Advisory Board. December 1970. 126 pages.

PB–197 261

Antimony has long been of use in commerce and industry. Applications have included the hardening of softer metals and the production of pharmaceuticals, pyrotechnics, and dyes. A recent and growing importance of antimony and its compounds as flame retardants in plastics and as catalysts has increased the need for a more detailed knowledge of antimony resources about the world. The document cites some data on production in various parts of the world. A discussion is given of widening use in ceramics and glass, stabilizers and fixatives, rubber vulcanization, pigments, textile delusterants, and other applications. Consumption and demand preductions are made.

—o—

UTILIZATION OF WASTE FLUOSILICIC ACID
1. LABORATORY INVESTIGATIONS.
2. COST EVALUATION.

Bureau of Mines. H. E. Blake, Jr., W. S. Thomas, K. W. Moser, J. L. Reuss, and H. Dolezal. April 1971. 66 pages.

PB–199 045

Fluosilicic acid ($H_2S:F_6$) is generated during the manufacture of phosphate fertilizers. The report describes two processes for utilizing this waste acid. The first process involves the conversion of fluosilicic acid to an acid-grade fluorspar (CaF_2) by first precipitating silica with ammonia and then reacting the ammonium fluoride filtrate with calcium hydroxide ($Ca(OH)_2$). The second process involves neutralizing the fluosilicic acid with calcium hydroxide and silica, filtering, and then volatilizing HF from the precipitate by pyrohydrolytic action at 1050C. The HF can then be used to produce aluminum trifluoride in an 83 percent yield. An economic evaluation showed that both products could be produced and marketed competitively.

* * *

THE CHEMISTRY OF GYPSUM AND ITS DEHYDRATION PRODUCTS. VOLUME 1. THE PHASES AND THEIR STABILITY AND SOLUBILITY. PART 1. GENERAL REFERENCES. PART 2. THE SOLID GAS AND SOLID VACUUM INTERFACES

Stanley Evan Edinger. September 1971. 244 pages.

PB–203 308

Gypsum is a natural hydrated calcium sulfate which has many important uses. It is used, for example, as a Portland cement retarder and soil neutralizer. When calcined, it finds use in wallboard, tile, and plasters. The report presents a comprehensive annotated bibliography on gypsum. The literature on the phases and their stability in the calcium sulfate—gas and calcium sulfate—vacuum systems and general references and reviews on the stability, solubility, and nomenclature of the various calcium sulfate phases is abstracted. The literature covers the period from antiquity to the present and is arranged in alphabetical order by the author's last names.

* * *

Process Engineering

DYNAMIC PROGRAMMING AND APPROXIMATION IN POLICY SPACE FOR OPTIMAL FEEDBACK CONTROL OF NONLINEAR SYSTEMS

Louisiana State University. Department of Chemical Engineering. Armando B. Corripio, Cecil L. Smith, and Paul W. Murrill. December 1969. 37 pages.

AD–702 085

The problem of optimal control of chemical processes has been given considerable attention in recent years. The purpose of this document is to illustrate the use of dynamic programming to calculate an optimal feedback control table that can be used by a digital computer to optimally control a process. The implementation of the technique is relatively simple and requires a minimum computation time. The programming required is simply a table look-up and interpolation routine. By way of example, the technique is used to calculate optimum temperature schedules for first and second order batch reactors.

—o—

PULSED-BED APPROACH TO FLUIDIZATION

Argonne National Laboratory. Chemical Engineering Division. Masaru Kobayashi. October 1969. 157 pages.

ANL–7592

A bed of solid particles can be maintained in a fluidized state if the gas flowing upward through the bed is kept within the proper velocity range. Similarly, a pulsed, intermittently fluidized bed results from controlling the gas so that it flows intermittently. The pulsed-bed approach to fluidization appears to offer certain advantages in gas-solid contacting, and the operation of this type of chemical reactor has been increasing. However, pulsed-bed characteristics such as bed behavior and heat- and mass-transfer are not well known. For this reason, an investigation was undertaken of pulsed-bed characteristics. The effects of various pulsing conditions on the pressure-drop pattern, maximum pressure drop, bed expansion, and bed movement were studied. The characteristics of heat transfer from an internal heater were also studied in relation to a number of configurations and operating conditions. It was found that pulsed-bed operation has remarkable advantages in a heat transfer process with large size and heavier particles, short heaters, and heaters located in the upper part of the bed. A heat transfer model is proposed which, together with the predicted bed stroke, can yield an estimate of the heat-transfer coefficients of a pulsed bed.

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RESEARCH AND DEVELOPMENT STUDIES INTO THE BASIC TECHNOLOGY OF RADIATION INDUCED EMULSIONS POLYMERIZATION INCLUDING SMALL SCALE PILOT PLANT SYSTEMS

North Carolina University. V. T. Stannett, E. P. Stahel, et al. September 1971. 141 pages.

ORO–3687–1

Emulsion polymerization systems are in principle ideal candidates for radiation initiation of polymer production. The high yield of free radicals from the radiolysis of water coupled with the long kinetic chains normally associated with emulsion polymerization should ensure good conversion from monomer to polymer. However, radiation initiation does have the possible disadvantage that it can lead to degradation, branching, or crosslinking of the polymer during polymerization. The report describes some laboratory and engineering studies on the radiation induced polymerization of butadiene and its copolymers with styrene and acrylonitrile, including a study of acrylonitrile itself and vinyl chloride in emulsion and under precipitating conditions. Polymerization rate expressions were incorporated into a mathematical model for the conversion history in the system using engineering models for each of the flow elements. The effects of the system engineering variables are presented. The pilot plant demonstrated the engineering feasibility of flow reaction systems utilizing radiation initiation to carry out emulsion polymerization.

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CHEMICAL REMOVAL OF NITRATE FROM POTABLE WATER SUPPLIES

Kansas Water Resources Research Inst. Walter J. O'Brien. June 1968. 101 pages.

PB–193 023

High concentrations of nitrate ion in potable water supplies are both medically and economically undesirable. Medical interest in this contaminant stems from the occurrence of methemoglobinemia in humans.If the intake of nitrate is large, oxygen starvation ending in death may occur. The disease is most critical in infants, usually in the first few months after birth, and may be caused either by nitrate in the water used in preparing the formula for bottle fed babies or by the milk from nursing mothers who drink water high in nitrate. To be practical, a method for removing nitrate from potable water supplies must be relatively inexpensive in both capital and operating costs, and applicable to individual homes or small communities. Two methods were studied: Chemical reduction using ferrous ions, and ion exchanging. Strong base type one-anion exchange resins showed considerable promise as a practical nitrate removal method. The ferrous reduction was found unsuitable. Of the resins studied, Amberlite 400 and Dowex 1–X4 were the most effective.

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SELECTED BIBLIOGRAPHY OF ELECTROSTATIC PRECIPITATOR LITERATURE

Southern Research Institute. March 1970. 161 pages.

PB–196 379

Electrostatic precipitators have long been in use as a means to reduce and recover particulates from industrial or municipal processes such as chemical manufacturing, fuel combustion, and incineration. This bibliography on electrostatic precipitators contains 1017 entries selected as being of lasting or timely interest. A subject index is included.

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STANDARD TEST METHODS FOR EVALUATION OF MEMBRANES

Columbia University. H. P. Gregor, E. F. Leonard, K. R. Brennan, P. F. McDonagh, and C. A. Rasmussen. November 1970. 152 pages.

PB–201 913

The ability of membrane processes to effect mass transfer without a change of phase has caused great interest in their characterization in science and engineering. For example, the mediation of transport processes across artificial membranes is of utmost concern to those engaged in the study of water desalination, artificial human organs, and biological separations. A number of groups are now working on the development of new membranes and the study of their fundamental properties. In the past these researchers have employed different methods for evaluating the permeability of a given membrane to diffusion. Unfortunately, using these different techniques has resulted in different diffusion coefficients for the same membrane material. The report describes research into the development of ion-exchange membranes to evaluate the absolute diffusion coefficients of given membranes. Good results were obtained when the diffusion coefficients of two cellophane membranes were determined.

STUDY OF A DESIGN-OPTIMIZATION PROCEDURE FOR ION-EXCHANGE AND ADSORPTION COLUMNS

University of California. S. Pancharatnam, G. Klein, and T. Vermeulen. September 1969. 124 pages.

PB–203 286

Optimal design of large-scale ion-exchange systems, such as those used in desalination, involves predictions of the effluent concentration history under repeated cycles in which incomplete exhaustion is alternated with incomplete regeneration. The report describes the exploratory study of a way to make such predictions, and of their use in optimization procedures. Controllable variables for a specified process are column dimensions, flow rates and running times which give rise to dimensionless length-time values. Output results are the recoveries and purities of desired components in effluent fractions and consequent cost functions. Graphs prepared as described determine how optimally to design or operate a column. A computer program is described which utilizes a 'ridge-climbing' technique to find the economically optimum design. Input to the program includes cost factors for resin, regenerant, apparatus, and power, and correlation constants obtained from a mass-transfer model of the system. Output comprises the optimum combination of bed height and exhaustion flow rate.

SURVEY OF COMMERCIALLY AVAILABLE CATALYSTS AND SORBENT MATERIALS

Battelle Memorial Institute. July 1969. 318 pages.

PB–203 358

The report provides a catalog of the available information on approximately 360 commercial catalysts, catalyst carriers, and sorbent materials. Data are tabulated on usages, costs, available sizes and shapes, hardness, crushing strength, pore size, pore volume, surface area, bulk density crystallinity, crystalite size, maximum operating temperature, attrition rate, loss of ignition, and composition. The catalog should, in its present form, be useful for data comparison, for screening, and as a decision-making tool.

Waste Processing and Materials Recovery

SOLVENT EXTRACTION OF NICKEL AND ZINC FROM A WASTE PHOSPHATE SOLUTION

Bureau of Mines. H. E. Powell, L. L. Smith, and A. A. Cochran. January 1970. 18 pages.

PB–190 028

The phosphate coating of metals in widely used in industry, especially in the manufacture of steel products. The report evaluates solvent extraction as a technique for the selective recovery of nickel and zinc from waste phosphate solutions. Not only can these metals be recovered, but also the pollution hazards caused by dumping these toxic materials into the environment is reduced. A 99% recovery of the nickel and zinc results when dinonyl maphthalene sulfonic acid (DNSA) is used as the extractant.

MICROBIAL CONVERSION OF HYDROUS CALCIUM SULFATE TO HYDROGEN SULFIDE

Bureau of Mines. J. D. Corrick, M. J. Rose, J. A. Sutton, and J. M. Carosella. March 1970. 19 pages.

PB–190 769

Currently there are a number of projects engaged in the recovery of elemental sulfur by chemical methods from smelter and flue gases as well as gypsum. The report discusses research conducted to develop operating techniques and define some of the limiting parameters for microbially converting hydrous calcium sulfate (gypsum) to hydrogen sulfide. The work was carried out in either glass stoppered flasks or anaerobic fermentors. Using the criteria of pH, temperature, number of bacteria per milliliter of test solution, and hydrogen sulfide produced, it was shown that hydrous calcium sulfate could be microbially converted to hydrogen sulfide at a rate of 7.3 g H_2S/l of fermentor volume per 24 hours. The various parameters defined were pH, temperature, and medium exchange rate.

RECOVERY OF LEAD AND SULFUR FROM GALENA CONCENTRATE, USING A FERRIC SULFATE LEACH

Bureau of Mines. F. P. Haver, K. Uchida, and M. M. Wong. March 1970. 17 pages.

PB–190 968

To help minimize air pollution and to prevent the loss of a valuable commodity, investigations are being carried out on methods to recover elemental sulfur in the processing of sulfide ores. This study is concerned with the treatment of galena. A procedure was developed for removing head and sulfur from galena flotation concentrate which includes the following steps: Aqueous oxidation using ferric chloride giving sulfur; regeneration of the ferric sulfate by electrolysis; treatment of the leach residue with ammonium carbonate; and electrolysis to recover the lead. About 90 percent of the lead can be recovered by the above method as 99.9-percent-pure metal, together with two-thirds of the sulfur—half in the elemental form and half as ammonium sulfate.

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PHENOLIC WASTE REUSE BY DIATOMITE FILTRATION

Johns Manville Products Corporation. E. I. Merrill. September 1970. 130 pages.

PB–199 069

For years the fiberglass manufacturing industry has had a problem of disposal of waste water containing expensive phenolic resins. In the fiberglass manufacturing process, airborne glass fibers are sprayed with a phenolic resin as a fiber blanket is formed on the collecting conveyor, causing a deposit of resin to form on the conveyor chain. The wastewater originates from the conveyor chain washing operation. A water reuse system has been developed which employs diatomite filtration to remove fine particulate matter. The system reduces the quantity of water required in the cleaning operation, permits the same water to be used 4.5 times before vaporation removes it from the system, and conserves the phenolic binder —all of which result in a substantial operational cost reduction. The technique may be extended to other manufacturing processes using phenolic binders.

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CANNERY WASTE TREATMENT KEHR ACTIVATED SLUDGE

FMC Corporation, Central Engineering Laboratories. Robert A. Fisher. September 1970. 70 pages.

PB–199 071

The activated sludge process is used for treating a variety of industrial wastes; however, these wastes often cause problems because of their seasonal nature and their shock loading effect on a conventional plant by way of sudden high strengths or flows. It appears that a system capable of processing high strength wastes is the Kehr modification of the activated sludge process, which uses a completely mixed aeration tank with no intentional solids wasting. The use of this process for treatment of both domestic sewage and higher strength food cannery wastes was successfully demonstrated. Aerobic digestion was obtained in the aeration tank in a completely mixed activated sludge plant at aeration times from 2 to 8 hours.

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TREATMENT OF AQUEOUS AGRICULTURAL WASTES FOR CLEAN WATER AND MICROBIAL PROTEIN PRODUCTION

Iowa State University. G. T. Tsao. June 1971. 40 pages.

PB–199 912

Cheese whey containing 35,000 ppm BOD is the most concentrated liquid waste that can be found in large quantities. It foams excessively when bubbled with gas. Cheese whey was successfully treated in a Waldhof aerator by Saccharomyces fragilis. This yeast can reduce about 85% of the BOD and produce single cell protein, which is collectable. A batch as well as a continuous growth process of this yeast was successfully developed. A fundamental study on the transient and steady state behavior of cell growth was conducted. The report also presents the first systematic study of a Waldhof separator. The Waldhof aerator functions properly by induction of air into liquid. In addition, if the liquid will foam when stirred and bubbled with air, the Waldhof aerator will achieve additional oxygen absorption by recycling foam and enjoying the large gas-liquid interfacial area in foam. The capability of the Waldhof aerator in handling aqueous agricultural wastes that have strong foaming tendencies has been demonstrated. The Waldhof aerator is probably the best mechanical system for handling lightly foamy liquors. It should have applications in the disposal of many types of liquid wastes. Foam fractionation of the yeast and other microbiological cells was also studied.

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WASTEWATER REUSE

National Water Commission. Jerome Gavis. July 1971. 164 pages.

PB–201 535

The three most common ways of making wastewater suitable for reuse are: Dilution of the polluted wastewater in the receiving stream; self-purification of the wastewater by the receiving stream; or complete treatment of the wastewater. Advanced methods of treatment, leading to complete or nearly complete purification of the effluent, are the principal focus of the report. However, combinations of the three principal approaches are usually possible, allowing somewhat less than complete treatment to furnish a fully reusable supply. Emphasis is on the resource value of wastewater. Potentials for reclamation of used municipal and industrial water are discussed in terms of direct reuse (recirculating) and indirect reuse (effluent from upstream use mixes with streamflow and is withdrawn downstream). Advanced treatment technology is described by processes for the removal of constituents in the effluents, with cost data and a review of major problems. Comparison with desalination and interbasin transfer costs is suggested. The need for research in evaluation and control of virological hazards is stressed. And the relationship of advanced treatment processes to secondary treatment processes is included.

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POLYMERIC MATERIALS FOR TREATMENT AND RECOVERY OF PETROCHEMICAL WASTES

Gulf South Research Institute. Elias Klein, Shyamkant V. Desai, James K. Smith, and Robert E. C. Weaver. March 1971. 78 pages.

PB–201 699

Over and above pollution abatement considerations, the effective in-plant treatment of petrochemical wastes has several economic advantages. These include the recovery of useful chemicals and the recycling of water. In a well designed reverse-osmosis system, the accomplishment of both of these objectives would go hand-in-hand. It has now been demonstrated that the high degree of selectivity necessary for recovering many valuable water soluble constituants from concentrated multicomponent petrochemical waste streams can be achieved with commercially available reverse osmosis membranes. Three modes of recovery using these membranes are described. A cost analysis indicates that such a system could be an extremely favorable investment.

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USE OF IMPROVED MEMBRANES IN TERTIARY TREATMENT BY REVERSE OSMOSIS

McDonnell Douglas Astronautics Company. H. K. Bishop. December 1970. 76 pages.

PB–203 206

Rapidly increasing populations and expanding industrial activities are placing greater demands on fresh water supplies. However, these supplies are relatively static in availability and in some cases even decreasing as the result of pollution. It has become apparent, however, that perhaps a much better source of water is reclamation by these methods of municipal wastewater since it contains far fewer dissolved minerals and is always available relatively near the intended use. Of the many demineralizing processes, the comparatively low-energy reverse osmosis process appears well suited to the renovation of municipal wastewater; and because of its apparent suitability, a reverse osmosis study with a threefold objective was conducted. Tubular membranes were prepared from trans esterified cellulose acetate and compared with membranes made from commercially available cellulose acetate (control). An evaluation was made of the in-situ regenerable membrane reverse osmosis design on wastewater. Finally the membranes were subjected to carbon treated secondary effluents, primary effluents, and concentrated primary effluents. Results showed that the modified tubular membranes produced fluxes slightly greater than the control membranes, while in-situ regenerable membranes produced fluxes significantly below those obtained with tubular units. On carbon treated secondary effluents, modified tubular membranes produced an overall average product water flux of 15 gfd, compared to 10 gfd for the control. Removal of wastewater constituents remained nearly constant at 90 to 100% for all three feeds, thus establishing the technical feasibility.

A STATE-OF-THE-ART REVIEW OF METAL FINISHING WASTE TREATMENT

Battelle Memorial Institute. November 1968. 88 pages.

PB–203 207

Electroplating and metal finishing waste streams are significant contributants to stream pollution, either directly, owing to their content of toxic and corrosive materials, such as cyanide, acids, and metals, or indirectly, owing to the deleterious effect these components exert on sewage treatment systems. Their is an ample technology available for treating chromium and cynanide rinse waters to any required degree of detoxification. The problem facing the smaller plater who may be forced to treat rinse waters before disposal is not expressed by the question "Can the job be done?" but by the question "What is the best and cheapest way for my particular plant to do the job?" The report surveys various waste cleaning methods, they include in-plant control measures for waste reduction, as well as chemical, physical, and biological detoxification techniques for the various waters to be treated. The methods presented were developed for use by the large scale manufacturing operations and are now presented for the benefit of the small operator.

CHEMICALS FROM SEA WATER BRINES

Office of Saline Water. Lee Leiserson. August 1969. 30 pages.

PB–203 266

Research on the desalination of sea or brackish waters has been primarily concerned with methods of recovery of potable water. Related subjects such as brine disposal and recovery of minerals from brine effluents have received only minor emphasis. The report evaluates materials recovery from the brine effluents generated by desalination. The following areas are reviewed: The previous work on mineral recovery, the value of the constituent salts of the brine, the processes by which materials might be recovered from brines, the relationship between mineral recovery and brine disposal, and the markets for both concentrated brine and salts. The principal conclusion is that the brine effluents from desalting plants are an economical source under appropriate conditions for the production of saturated (10 to 1) brine, sodium chloride, and other minerals. The production of these materials requires relatively simple technology.

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BIO-REGENERATED ACTIVATED CARBON TREATMENT OF TEXTILE DYE WASTEWATERS

Fram Corporation. Clarke A. Rodman, and Edward L. Shunney. January 1971. 75 pages.

PB–203 599

Biological treatment of wastewater can be markedly improved by providing a myriad of solid surface upon which biological growth is accelerated. It is evident then that proper utilization of an adsorbent with a biological waste treatment process might provide an important step in designing more effective and less expensive waste treatment systems. A novel approach to treating a highly colored textile dyeing waste effluent is described. It comprises the removal by sorption of color bodies and other organic matter on activated carbon granules. Spent carbon granules are then subjected to a virule aerobic biological culture which desorbs and bio-oxidizes the desorbed matter, thereby regenerating the carbon for subsequent new sorption steps. Laboratory confirmation of the phenomenon is presented. Field testing of the treatment process concept in a 50,000 gpd plant installed at a yarn spinning mill is reviewed, and cost data are provided. Color removal was virtually complete at two flow rates evaluated.

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CONVERTING ORGANIC WASTES TO OIL. A REPLENISHABLE ENERGY SOURCE

Bureau of Mines, Pittsburgh Energy Research Center. H. R. Appell, Y. C. Fu, Sam Friedman, P. M. Yavorsky, and Irving Friedman. 1971. 24 pages.

PB–203 669

A significant part of the energy demand of a nation can be obtained on a renewable basis by converting nearly every kind of organic solid waste to a low-sulfur fuel oil by the newly developed process which is the subject of this report. In its essence, the process involves the treatment of the organic materials with carbon monoxide and water under pressure. All types of cellulosic wastes, including urban refuse, agricultural wastes, sewage sludge, wood, lignin, and bovine manure, have been successfully converted to oil. Initial trials with sucrose, a typical carbohydrate, were also successful.

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RECOVERY OF CHROMITE AND SILICA FROM STEEL FOUNDRY WASTE MOLDING SANDS

Bureau of Mines. P. G. Barnard, R. A. Ritchey, and H. Kenworthy. July 1971. 21 pages.

PB–203 890

Molding sands used in many foundries today no longer consist simply of silica and a binder. Mold areas where extra refractoriness is required to resist hot spots and areas susceptible to erosion are countered by sand blending or mold patching with materials such as chromite and zircon. Most foundry molding sands are recycled within their plants until they become unusable through agglomeration or because of excessive coating with deleterious materials. This portion of the sand is then discarded since it no longer has the required properties. To eliminate this waste, a method was developed to clean the sand particles and recover the valuable components by using physical separation techniques. A simple scrubbing followed by an oxidation roast is used to produce a quality sand which can be reused. If the waste sands contain chromite, a magnetic separation will separate this relatively expensive component after the cleaning treatment. A large steel foundry that has recently adopted the process for recovering chromite and silica from its waste molding sand is presently recovering for reuse about 20 tons of chromite and 80 tons of silica sand per day.

BUREAU OF MINES RESEARCH PROGRAMS ON RECYCLING AND DISPOSAL OF MINERAL, METAL, AND ENERGY BASED SOLID WASTES

Bureau of Mines. Charles B. Kenahan and Einar P. Flint. 1971. 57 pages.

PB–205 663

The mineral resources of a nation, once mined, are irreplaceable, and in a condition of increasing scarcities, the development of methods for recovering, recycling, and reusing metal materials becomes a necessity. Present investigations are being made in consideration of the possibility that mine tailing dumps, junk car graveyards, and municipal landfills may constitute man made mines for minerals and metals whose natural ores can be mined only at greater cost than that of recycling wastes. The document discusses various features incident to this kind of program: Reclamation and reuse of waste glass, refining of metals from refuse and incinerator residues, utilization of discarded plastics, pyrolysis of solid wastes, and conversion of organic refuse to oil. Upgrading and utilization of automotive and related ferrous scrap is discussed, as well as utilization and stabilization of mine, mill, and smelter wastes, and the recovery and reuse of scrap metals, precious metals, sulfur dioxide, dusts, waste plating solutions, sludges, lead battery scrap, and ashes. A considerable bibliography is included.

MATERIALS

Ceramics and Glass

IMPLEMENTATION OF ADVANCED TECHNOLOGY FOR CAST METALS AND REFRACTORIES. ZIRCONIUM OXIDE

Dartmouth College. George A. Colligan. March 1970. 63 pages.

AD–706 221

Zirconia, or zirconium dioxide, is a highly refractory ceramic material especially useful in high-temperature applications such as crucibles, nozzles, insulation, brickwork, and metallic parts coatings because of its high melting point and low chemical reactivity; it cannot be used in the pure form, however, because of an allotropic and destructive phase transformation which occurs around 1000 degrees C. Therefore considerable investigation is being conducted to obtain additives capable of stabilizing the compound—magnesium oxide in particular. The report deals with the behavior and possibilities of a ZrO2-MgO system, using a mathematical model of the stabilization process to explain crystalline phase characteristics, and it draws commercially significant conclusions as to use of the system. Attention is called to a disagreement in the literature as to the position of the eutectoid point, and indications are made for further research.

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FABRICATION AND CHARACTERIZATION OF HOT PRESSED Al_2O_3

Naval Research Laboratory. Roy W. Rice. July 1970. 31 pages.

AD–709 556

Hot pressing is known to improve the strength of Al_2O_3. In this report, the hot pressing of Al_2O_3 with and without the addition of LiF is described, and the resultant bodies are described. LiF was found to significantly enhance densification, allowing dense bodies to be obtained at temperatures 200–300 C lower than without additives. Gaseous impurities were detected and identified, and it was possible to demonstrate known and possible effects that they have on fabrication, microstructure, and behavior of bodies made from Al_2O_3 powders.

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EFFECTS OF SURFACE FINISHING ON MECHANICAL AND OTHER PHYSICAL PROPERTIES OF CERAMICS

Honyewell Corporate Research Center. R. J. Stokes. December 1970. 38 pages.

AD–716 886

Ceramics, because of their unique physical properties, have found increasing use in industry and engineering. The fabrication of smaller and smaller components, resulting in corresponding increases in surface to volume ratio, brings surface properties into prime significance, so that surface finish and surface finishing may become critical. The report reviews the characteristics of machined ceramic surfaces, giving experimental illustrations where these are available. A discussion is presented of the features generated in material removal by brittle fracture, and in plastic flow by abrasive machining and the exposure of internal structure by cross sectioning. Other discussions concern the effects of surface finishing on the mechanical, magnetic, electrical, and optical properties of ceramics. The characteristics of single crystals, polycrystals, and semiconductors are noted.

SURFACE-COMPRESSION STRENGTHENED GLASSES: SOME PROPERTIES.

Naval Ordnance Laboratory. Henry A. Perry. March 1971. 84 pages.

AD–721 327

A surface-compression strengthened glass component is a vitreous structure which has been treated so that the glass of the surface region remains in a state of compression after the article is formed. The treated article resists breakage until sufficient force is applied to cancel the surface compression stress. Methodology noted in the report includes chill-tempering, glazing, thermal diffusion ion exchange, and electro-ionic substitution. The document reviews some of the properties of surface-compression strengthened glasses, such as strength and stiffness, density, thermal and electrical properties, and environmental resistance. Engineering properties discussed include elastic constants, dimensional stability, and relaxation times; resistance to compression, fatigue, solid impact, underwater shockwaves, rain erosion, biomarine exposure and radiation. Attention is called to advantages for use in light weight structures, and suggestions are made for application to optical, structural, and electrical engineering.

THE EVALUATION OF GLASSES AS FORGING LUBRICANTS

Westinghouse Electric Corporation. A. T. Male, F. J. Gurney, and T. E. Jones. April 1971. 55 pages.

AD–726 583

In extrusion operations for the processing of metals, where high deformation temperatures are required, a workpiece coating has been found to be economically effective, particularly in combination with a grease-base lubricant on the tooling. The document describes the use of a ring compression test to determine the relative lubrication qualities of various workpiece coating substances. The ability of glass coatings to favorably influence the interface characteristics of the workpiece and tool is discussed in some detail, and attention is given to friction and heat transfer effects in the system. The results of an investigation of three glass coatings are given.

COMMINUTION OF A REACTIVE ALUMINA POWDER

Battelle, Columbus Laboratories. R. B. Bennett, D. E. Niesez. October 1971. 24 pages.

AD–731 716

Investigations of powder characterization and the relationship of microstructure and properties in reactive aluminas have indicated that the most detrimental characteristic in the powders is their aggregate structure. Reduction of the aggregates in such powders to an ultimate particle condition constitutes one approach by which the effect of aggregates on powder processing behavior, microstructural development, and property realization can be directly traced. Of several potential means to achieve this comminution, ball milling affords a choice which is attractive because it offers not only the advantages of suitability for experimentation with small sample lots but also acceptability as a commercial powder processing technique of long standing. Unfortunately, the dry milling of reactive alumina powders presents special problems because of a tendency for the powder to pack, or agglomerate. In the investigation, dry ball milling and wet ball milling in different liquids were evaluated as techniques for eliminating porous aggregates from powders. The effects of milling on surface area, compaction behavior, sinterability, and microstructural uniformity of sintered compacts were evaluated. These results were correlated with changes in agglomerate and aggregate structure as determined by electron microscopy.

PREPARATION AND CHARACTERIZATION OF HIGH PURITY SUBMICRON REFRACTORY OXIDES AND MIXED OXIDES FROM ALKOXIDES

University of Cincinnati. Michael Hoch. August 1971. 130 pages.

AD–731 826

The development of better and more useful ceramic materials, as well as the introduction of new ceramic materials in industry requires that materials with high purity and well controlled properties be available. A method was developed to prepare high purity, highly uniform, very reactive, small, under 100A crystallite size ceramic powders. The method consists of preparing a water sensitive organo-metallic compound, preferably an alkoxide, and decomposing it by hydrolysis. The hydroxide is then washed using high purity water or alcohol, dried, ball milled, and finally calcined at 550C. By varying the treatment of the hydroxide, two different types of powders, A and B, were obtained. Powder A is suited for hot pressing consolidation, and powder B for cold pressing and sintering. The method was specifically developed for the large scale preparation of zirconium oxide containing 6.5 mole % yttrium oxide. This yttria-stabilized zirconium oxide of high purity and small grain size is a good high-temperature structural material for heat exchangers operating at up to 2400C. It could also be useful for oxygen potential measurements in the steel industry and high temperature oxygen fuel cells. A similar process was successfully applied to other ceramic materials such as ferrites, and PLZT, lead lanthanum zirconate titanate.

PREPARATION OF FIBERED CERAMICS BY MECHANICAL DEFORMATION

Lewis Research Center. Robert W. Jech, John W. Weeton, and Robert A. Signorelli. April 1970. 28 pages.

N70–23279

One way to make high-strength materials is by using strong fibers to reinforce a relatively weak matrix. Ceramic fibers are attractive candidate reinforcing materials because of their high thermal stability, relative inertness, very high temperature, and low weight per volume. The major obstacle to the development of such composite materials has been the lack of suitable ceramic fibers. It has now been found that the fibers can be formed within the matrix material by extruding metal (matrix) powders containing ceramic particles. The document describes the extrusion of zirconium oxide, hafnium oxide, and thorium oxide in a tungsten matrix, and gives the results of an examination of the properties of the fibers formed thereby.

INVESTIGATION TO DEVELOP A PROCESS FOR PRODUCTION OF OXIDE FIBERS BY MELT DRAW TECHNIQUE

Denver Research Institute. Henry E. Otto and Dwight G. Moore. July 1970. 40 pages.

N71–10048

One of the promising new structural materials is the fiber-reinforced metal structure, utilizing a ceramic oxide crystalline fiber which is expensive to produce in the high-strength single crystal form. The document reports on an investigation to achieve high strength in polycrystalline fibers by a special melt method. A melt-drawing process using polycrystalline alumina is described, in which fibers were formed by drawing small diameter thoriated tungsten wires through a bath of the molten oxide. The oxide coating increased the load bearing capacity of 1-mil tungsten fiber by as much as a factor of five. Experimental data is given on materials, equipment and melting procedures, dipping tests, single-pass and multiple-pass melt drawing processes, microstructure, and tensile tests.

ROLL FORMING STRIP FROM OXIDE POWDERS

Bureau of Mines. Henry M. Harris, Bob L. Forkner, and Hal J. Kelly. December 1970. 29 pages.

PB–196 690

The report concerns the relatively new process of roll forming ceramic strip for industrial applications, with especial attention to the search for effective processing methods which will reduce fuel consumption and eliminate the waste of materials resulting from defective products. It has been found possible to produce high-quality porous or dense alumina, zirconia, and porcelain shapes by sintering strip roll formed at room temperature from powders. A description is given of the powders, the mixing procedures, and forming methods, and the results of binder and water content, strip thickness and roll gap, roll speed and surface, particle size, and microstructure are included. Reshaping methods, such as cutting, grinding, shearing, and stamping, are also described.

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PHOSPHATE COATINGS (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. February 1971. 51 pages.

AD–720 201

The bibliography is comprised of summaries of U.S. Government funded reports on phosphate coatings. Topics covered include the protection of metals from heat and flame, and the development of coatings resistant to friction and corrosion. Various compounds which are of use in paints and ceramic coatings are discussed, such as lubricants and oils, plastics, organic acids, metal organic substances, and pigments. Heat resistant paints and phosphatizing baths are described. Materials are given on oxides, borides, carbides, anodic coatings, and chromates. Metals considered for protecting and protection are tin, zinc, silver, cadmium, nickel, iron, steel, aluminum, magnesium, and dissimilar metals, in particular. The effects of static loading and temperature are discussed, and the results of salt spray tests are recorded. The reports listed in the bibliography are available from NTIS.

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REFRACTORY COATINGS. (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. February 1971. 96 pages.

AD–720 203

The bibliography contains abstracts of U.S. Government funded research on refractory coatings of many types, including oxides, carbides, nitrides, and borides; compounds of titanium, niobium, and silicon; and materials such as cermets, composite materials, ceramics, and heat-resistant materials. Processes are described, including the plasma arc, flame spraying, vapor plating, sputtering; and protection of tungsten wires, refractory metals, and graphite and carbon. Oxidation protection at high temperatures, coating failure analysis, and the properties of structural plastics are discussed. Applications to a number of fields of engineering are considered. The references cover the period 1953–1970, and the reports listed are available from NTIS.

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A STUDY OF MANGANESE PHOSPHATING REACTIONS

U.S. Army Weapons Command, Research Directorate. Joseph Menke. September 1971. 21 pages.

AD–731 482

Manganese-phosphate coatings have been applied to ferrous materials for many years. The coating consists of an insoluble metal phosphate which is formed in a solution of phosphoric acid and other chemicals. Corrosion resistance obtained with a bare manganese-phosphate coating is usually limited. The report discusses research which was involved with the development of a manganese-phosphate coating that provides a significant increase in salt-spray corrosion resistance when compared with conventional manganese-phosphate coatings. An improved phosphate coating was studied as produced from a stock manganese phosphating bath to which an addition of manganese citrate, artrate, or gluconate was made. Processing was accomplished in an autoclave at temperatures above 212F with steam pressure. The coatings produced by conventional and pressure methods were examined by differential thermal analysis, X-ray diffraction, and atomic absorption analysis. The new coating also has excellent corrosion resistance after being heated for an hour at temperatures of 450F.

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DEVELOPMENT OF NONFLAMMABLE COATING FOR POLYCARBONATE

Monsanto Research Corporation. M. C. Willson, C. E. Semler. March 1969. 88 pages.

N70–20063

Polycarbonate has good optical and impact properties and is currently utilized in transparent visor and instrumentation applications. However, because of the flammability of this substance, it was considered necessary to develop a nonflammable coating for it. Three types of coatings are described: Alkali silicates; non-alkali silicates; and plasma-sprayed glass. Only the silicates were found satisfactory. Data are provided on flame resistance, light transmittance, optical uniformity and distortion, humidity and thermal shock resistance, vacuum and ultraviolet stability, and flexural and impact strength of the films.

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THIN CONFORMAL COATINGS, A BOON TO THE ELECTRONIC ENGINEER

National Aeronautics and Space Administration. J. M. Fisher. 1970. 13 pages.

N70–35903

A conformal coating is one of a large variety of substances which can both cover and conform to the outline of a surface or structure. protection from moisture and air-borne contaminants such as salts and sulphur compounds, and prevention of fungus growth; handling protection, preventing damage from salts, oils, and sulfur compounds which may be hand-borne during assembly or field testing; ruggedization or protection from shock or vibration during handling, testing, or use; and insulation protection. The document discusses types of coatings, desirable characteristics, and cost considerations, with special emphasis on applications to electrical and electronic circuits.

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CONFORMAL COATINGS FOR PRINTED WIRING BOARDS

National Aeronautics and Space Administration. J. M. Fisher Jr. and C. J. Bryan. 22 pages.

N70–35944

Conformal coatings are substances which can both cover and conform to the outline of a surface or structure. Ranging from epoxies, silicones, and polyesters, they have received wide use in moisture and corrosion protection, insulation, and ruggedization of printed circuit boards and terminal blocks. The report is concerned with the conformal coating requirements of an environment where a wide variety of severe conditions may be encountered, such as a combination not only of corrosion and moisture intrusion but also of shock and vibration. Accordingly testing procedures have been developed for complete systems, and a discussion is made of such a procedure for a printed wiring board which includes its components and coatings. A qualification program is described which involves resonance changes, insulation resistance, compatibility, fungus resistance, thermal shock, ruggedization, fluorescence, and flame resistance. Specifications are also discussed, and some conclusions are drawn.

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SHATTERPROOF COATINGS FOR GLASS

Oak Ridge National Laboratory. R. J. Gray. March 1970. 15 pages.

ORNL–4521

There are numerous occasions in the laboratory when glass is the most suitable material for container or plumbing systems. A serious drawback of glass is, of course, its well-known inability to withstand thermal shock and impact. The subsequent scatter of many sharp fragments can be a serious safety hazard. It has now been found that glass can be successfully shatterproofed in the laboratory by coating the surface with a silicone rubber dispersion. Items so coated included light bulbs, Pyrex tubing, Dewar flasks, and capillary tubes. It is felt that many other applications of these coatings are possible.

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ELECTRICAL AND THERMAL TRANSPORT MODELS FOR ANALYSIS OF REINFORCED COMPOSITES

Battelle Memorial Institute. Jules J. Duga. July 1966. 48 pages.

AD–486 667

In the past decade, a concerted effort has been put forth on the development of two-phase (composite) materials which show promise of obtaining selected physical properties superior to those previously available in single-phase materials. The factors which determine the usefulness of a particular two-phase material are largely influenced by the eventual area of application. This document concerns the development of experimental and analytical techniques to determine some of the subtler aspects of composite performance. Consideration is given to the different types of analytical techniques which have been forwarded to describe the electrical and thermal transport in such materials, and the merits of each type of approach are discussed. It is shown how the qualitative results can be applied to specific systems. Theoretical expressions are compared with selected experimental data and the applicability of the analytical approach to other types of investigation is demonstrated.

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TESTING AND CHARACTERIZATION OF COMPOSITE MATERIALS

Air Force Materials Lab. J. M. Whitney. June 1971. 47 pages.

AD–731 759

Composite materials are widely utilized in industry because the characteristics of a combination or reinforcement may be superior to those of a single material, or the anisotropy imparted by geometrical differences in substance alignment can be used to obtain special qualities. Tests for such anisotropic composites must be devised not only to provide experimental data on moduli and other mechanical properties, but also to characterize the complete physical response of the material up to and including failure. The document presents the use of a thin walled tube as a reliable procedure for analyzing the properties of fiber reinforced composites. Consideration is given to laminates, axes of symmetry, tensile loading and stresses, unsymmetric composites, beam data and equations of motion, and off-axis deflections. Shear tests are described, along with the use of torsion rods, a rail shear method, and the effect of end attachments. Attention is given to the analysis of stresses in laminated tubes. The result is a characterization of the stiffness, creep, and strength characteristics of the fiber reinforced system.

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FLOW MOLDING OF DISCONTINUOUS FIBER REINFORCED PLASTICS

Monsanto Research Corporation. L. A. Goettler. March 1969. 127 pages.

AD–849 965

The document provides a survey of the literature relating both to the practice of molding discontinuous fiber reinforced plastics and the interpretation of orientation and flow phenomena according to currently available theory. In addition, some references on practical aspects of resin moldability and processing are included.

RIBBON REINFORCEMENTS IN COMPOSITES

Monsanto Research Corporation. Thomas B. Lewis. December 1969. 25 pages.

AD–865 290

The importance of rectangular cross section fiber (ribbon) reinforcement for composites is evident from a comparison with composites using circular cross section fibers. For the latter with parallel orientation, there is a maximum reinforcement in strength and modulus in the direction of the fiber length. In the plane perpendicular to the direction of the fibers, a small increase in modulus is realized, but generally there is a decrease in strength compared to the matrix. The advantage of using ribbons is that the strength and modulus in the latter plane are nearly equal to the properties in the direction of the fiber length. Experimental results for a model system are reported which demonstrate the extent to which isotopic strength and modulus can be approached with ribbon reinforcements. It is shown that if rectangular cross section fibers of suitable materials can be produced, the requirement for composite materials with isotopic properties in a plane can be fulfilled.

FLOW MOLDING AS A METHOD FOR A FABRICATING METAL MATRIX COMPOSITES

Monsanto Research Corporation. R. G. Schierding and T. L. Tolbert. November 1969. 33 pages.

AD–866 167

The principal advantage of using discontinuous, high modulus fibers as reinforcing agents lies in the fact that resulting composites can be readily molded into much more complex shapes than are generally obtainable with continuous filaments or fabrics. Furthermore, the orientation of the reinforcing fibers can be controlled to give increased, directed reinforcement where required. For such composites to be of commercial importance, however, reliable methods must be found for producing them economically and in quantity. Fiber reinforced metal composites have now been successfully fabricated using flow molding techniques. Composites were produced by both extrusion and transfer molding. This report describes the methods employed.

THE MECHANICAL PERFORMANCE OF CROSS-PLIED FIBER GLASS-EPOXY COMPOSITES

Monsanto Research Corporation. Ori Ishai and R. E. Lavengood. January 1970. 33 pages.

AD–869 004

Unidirectional glass-epoxy composites are among the strongest structural materials available. Today, however they are of limited usefulness because of their extreme anisotropy. Frequently the strength of such systems is 25 times as great in the direction of the fibers as in the transverse direction. Thus, for most practical applications, multidirectional composites are necessary, despite the fact that shifting part of the fibers away from the major stress axis decreases the theoretical efficiency of the composite. This report discusses orthotropic cross-lies which offer a reasonable compromise between the extreme anisotropy of the unidirectional system and the quasi-isotropy of the random one. A description is given of the effects of matrix deformational characteristics on the overall mechanical performance of cross-plied composites. Particular emphasis is placed on the effect of the matrix on the strength efficiency of the composites.

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FABRICATION OF THERMOPLASTICS FILLED WITH DISCONTINUOUS FIBERS BY INTERFACIAL INJECTION

Monsanto Research Corporation. John L. Kardos and Steven R. Lowy. January 1970. 22 pages.

AD–869 600

In any process to fabricate composite materials filled with discontinuous fillers, the major goals are good filler dispersion, controllable orientation (particularly in the case of fibers), good adhesion between phases, and a reasonably high filler content. The report describes a new method for incorporating discontinuous filler in thermoplastic matrices which meets these requirements. The technique combines the phenomena of interfacial polymerization and subsequent flow of polymer and solvent to provide one-step insertion of any type of discontinuous filler into certain types of thermoplastic matrices. The process results in almost no damage to the filler particles, whereas existing multi-step methods nearly always result in some filler breakage. Details of the process are presented and the results from batch experiments illustrating effects of several process parameters on product properties are described.

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PREPARATION AND TESTING OF SHORT FIBER MOLDING COMPOUNDS

Monsanto Research Corporation. H. M. Andersen and D. C. Morris. May 1970. 104 pages.

AD–869 813

The utilization of very small and stiff chopped fibers or whiskers as reinforcements for composite materials requires primarily a practical and economical method of fabrication. The report describes a method for preparing epoxy molding compounds of short, high modulus fibers. It involves encapsulation of fiber with precatalyzed resin in an aqueous slurry of the components and the result is a compound in the form of discrete grains. The fibers in each grain are collimated and individually imbedded in the resin matrix. Most of the work was done with glass as a model material, but the applicability of the process is demonstrated for boron fiber and crocidolite asbestos. The mechanical properties of the uniaxially reinforced pieces are generally good.

PREPARATION AND CHARACTERISTICS OF CONCRETE-POLYMER COMPOSITES

Brookhaven National Laboratory. M. Steinberg, L. E. Lukacka, P. Colombo, and B. Manowitz. January 1970. 27 pages.

BNL–14350

The report summarizes research in concrete-polymer composites. These are materials in which concrete is inpregnated with a polymer which is polymerized in situ by either radiation or thermal-catalytic techniques. The concrete-polymer has been found to have substantially improved structural properties and durability compared with those of conventional concrete. The improvement in properties appears to be a function of the polymer loading. Increases in strength by as much as a factor of four over that of the control specimens have been obtained. Concrete corrosion was found to be reduced to negligible amounts. The thermoplastic monomers methyl methacrylate, styrene, and chlorostyrene are of value for normal temperature applications. It has also been found that a concrete-polymer significantly increases the bond strength and flexural strength of steel-reinforced and fiber-reinforced concrete. A preliminary comparison between concrete-polymer and other materials of construction indicates reasonable economic potential for certain applications.

Construction Materials

EVALUATION OF POLYMER EMULSIONS TO SERVE AS SOIL TREATMENTS FOR DUST CONTROL

Western Company of North America. Jack B. Hammond. March 1971. 49 pages.

AD–722 795

The report concerns the development or improvement of a polyvinyl acetate polymer emulsion for use as a soil surface treatment for dust control. Tests were conducted on both modified and unmodified samples. These tests included determination of physical properties with particular emphasis placed on toughness. Environmental tests included exposure to ultraviolet light and water spray, soil bacteria, and fungi and heat aging. Modifications studied included viscosity, plasticizers, and fungicides. An improved formulation was developed.

SURVEY OF APPLICATIONS OF EPOXY RESINS FOR CIVIL WORKS PROJECTS

Army Engineer Waterways Experiment Station. Clara F. Derrington, and Leonard Pepper. July 1971. 78 pages.

AD–728 813

A survey is provided of the uses which have been made of epoxy resins in civil works engineering, and of information concerning durability in service and other pertinent factors that might be used in determining the suitability of this material for specific applications. The general types of applications considered include: Bonding fresh concrete to hardened concrete; patching and filling cracks; applying protective coatings, waterproofing, and sealing joints; bonding metal to hardened concrete; applying coatings for erosion resistance; and bonding hardened concrete to hardened concrete. Included in the document is a field guide of recommended practices for the use of epoxy resin formulations with concrete.

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CONCRETE-POLYMER COMPOSITES FOR UNDERWATER APPLICATIONS

Brookhaven National Laboratory. L. E. Kukacka, P. Colombo, M. Steinberg, and B. Manowitz. 1969. 18 pages.

BNL–14267

Compressive and tensile tests were conducted on concrete impregnated with a methyl methacrylate mixture. A 327% improvement was found over regular concrete. Exposure tests showed excellent durability. It was found that thermally treated concrete-polymer material generally had a lower strength value than radiation-tread material. Also studied were steel fiber and steel rod reinforced concrete. Again the methyl methacrylate impregnated materials showed improvements over conventional systems.

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CONCRETE-POLYMER MATERIALS

Bureau of Reclamation, and Brookhaven National Laboratory. J. T. Dikeou, M. Steinber, et al. January 1971. 111 pages.

BNL–50275

Research and development work on concrete-polymer composite construction materials is described. These materials offer high strength and improved durability. The most successful concrete-polymer material yet developed is the polymer-impregnated concrete (PIC). However, there is much interest in polymer-cement concrete where the water, aggregate, portland cement, and monomer are mixed together and the monomer polymerized after setting. Also being developed is the polymer-concrete, a composite material formed by polymerizing a monomer and aggregate mixture. The report discusses the following: Evaluation and selection of monomers; development of process techniques; testing and measurement of physical and mechanical properties; applications; and cost estimates.

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REVIEW OF FEDERAL RESEARCH AND DEVELOPMENT IN PAVEMENT STRIPING MATERIALS

George Washington University. July 1971. 120 pages.

N71–33594

The report summarizes available information on U.S. Government funded research and development efforts directly relevant to traffic marking materials, with focus on pavement striping. The areas of study emphasized are decrease in drying time, increase in wet weather visibility, increase in durability including normal wear and snowplow damage, increase in adherance to pavements, and increase in cost effectiveness of striping systems. Substances discussed are reflective materials, traffic beads, glass beads, plastic marking materials, paint for concrete, and road marking materials. Technology of design and marking practice is covered.

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STRENGTHS OF SULFUR-BASALT CONCRETES

Bureau of Mines. Lester J. Crow, and Robert C. Bates. March 1970. 25 pages.

PB–190 649

The search for new common materials suitable for shelter construction has led to an investigation of the possibilities of elemental sulfur as a bonding agent. The document reports on thermoplastic sulfur aggregate mixtures, reviewing the physical and mechanical properties of sulfur, including vacuum behavior, thermal characteristics, phase changes, allotropic forms, and sublimation, noting the reliability of data found in the literature. The results of tests on sulfur concrete cylinders are discussed, including heating and cooling actions, compressive strength, and compression-failure data.

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A STUDY OF COATING BASED ON WATER SOLUBLE LINSEED OIL TO BE USED AS A CONCRETE CURING MEMBRANE

North Dakota State University. Robert A. Heskin, April 1970. 97 pages.

PB–192 483

A linseed oil based liquid concrete curing membrane has been developed which can be applied to wet concrete under a large range of temperature and humidity conditions, and which can be used on highway surfaces in lieu of polyethylene sheeting and proprietary wax and/or resinous compounds. The compositions are water soluble, dry rapidly on wet surfaces, and are impermeable to water vapor. Field tests have shown that concrete cured with the compositions have properties equal to or superior to concrete cured with the aid of polyethylene sheeting. Optimum membranes were compounded from linseed oil with the addition of fumaric acid and triethylamine.

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EFFECT OF SOME AGGREGATE CHARACTERISTICS ON THE FATIGUE BEHAVIOR OF AN ASPHALTIC CONCRETE MIXTURE

Virginia Highway Research Council. G. W. Maupin, Jr. July 1970. 20 pages.

PB–196 527

The variation in wear and fatigue behavior of asphaltic concrete highways has prompted investigation of the possible contributing factors, including prevailing temperature, binder types and properties, asphalt percentages, air void content, stiffness, and aggregate qualities. In recognition of the importance of aggregates, studies were conducted on crushing, shape, angularity, roughness, and similar qualities. The report describes laboratory tests of asphaltic limestone mixtures, involving flexure, surface texture, rugosity, and flakiness, in the attempt to correlate these characteristics with fatigue behavior. Indications are made for the prediction of fatigue life.

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RESEARCH ON ASPHALTIC MATERIALS

Florida University. H. E. Schweyer, and J. C. Busot. August 1969. 67 pages.

PB–196 973

Research is reported on the asphalt content of bituminous pavements with the aim of developing specifications for withstanding environmental stresses and atmospheric phenomena which cause asphalts to change their original properties and produce deformations when a highway is in service. The plan was to study the rheological behavior over a range of temperature and conditions of deformation in order to measure response and establish the differences which are encountered in materials used. The report contains a classification of asphalts by rheological response, description of a cluster analysis technique, and discussion of the application of such analysis to rheological response. Experimental work on asphalt cements is also described, along with the results of durability and specification tests.

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A STUDY OF CONCRETE CONSOLIDATION

Alabama State Highway Department. Leland M. Kraft, Jr. April 1970. 51 pages.

PB–197 149

The mechanical properties of highway concrete are the result of factors ranging from materials and mixing methods to moisture concentration and entrapped air. The document reports on an investigation arising from the discovery of an undesirably high number of air and water pockets in test cores of concrete pavement in Alabama, attributed to inadequate compaction of the concrete when fresh. The effect of vibration was studied as a means of obtaining increased compactability through the reduction of entrapped air content, thereby gaining more efficient use of the cement in the mix. These variables were studied: Three coarse aggregates, varying in size and shape; two vibrator frequencies with three amplitudes, in varying lengths of time; and three concrete thicknesses. Results are discussed as a means of improving the understanding of the factors which influence the compactability of concrete.

CARBONATE BONDING OF COAL REFUSE

Black, Sivalls, and Bryson, Inc. Paul J. LaRosa, James A. Karnavas, and Eugene A. Pelczarski. February 1971. 57 pages.

PB–198 230

The carbonate bonding process utilizing coal refuse as a fill material consists of mixing coal refuse with water and lime hydrate, compacting the mixture, and reacting it with a carbon-dioxide-rich gas to form a coherent structure bonded by a matrix of calcite crystals. The need for such a process arises from the fact that as rain water percolates down through a spoil bank, the reaction between pyrites, air, and water generates acid-forming constituents which are carried in the water table or streams surrounding the locale. One application of the process is the sealing of coal refuse piles with a layer of carbonate-bonded refuse to exclude air and moisture from the pile, and thus eliminate the formation of acid drainage. A second application of this process is the elimination of refuse piles by utilizing the refuse material as filler in the construction of carbonate bonded road pavement and in the manufacture of low-cost bricks and similar products. Four types of coal refuse were investigated—a relatively unoxidized and highly oxidized bituminous coal refuse and a relatively unoxidized and highly oxidized anthracite coal refuse. The air and water permeability of carbonate bonded coal refuse was found to be comparable to concrete. An approximate cost comparison between carbonate bonded coal refuse and other construction materials and techniques indicated that the carbonate bonding process utilizing coal refuse is the least cost means available for coal refuse pile sealing and road building.

ASH UTILIZATION

Bureau of Mines. John H. Faber, Neil H. Coates, and John D. Spencer. March 1970. 355 pages.

PB–198 260

Because of the large amounts of fly ash produced by industrial and municipal combustion processes, any utilization of this ash would be of great economic benefit. The report is a compilation of papers presented at the 2nd Ash Utilization Symposium, Pittsburg, Pennsylvania. The titles of these papers are the following: Production and utilization of ash in the United States; The inhibitory effect of fly ash with respect to the corrosion of steel in concretes; Fly ash concrete in buildings in Chicago; A review of ash specifications; Prediction of fly ash performance; Fly ash as a bituminous filler; Technical aspects of fusion forming of fly ash ceramic structures; Utilization of fly ash for remote filling of mine voids; New or underdeveloped methods for producing and utilizing coal ash; PFA utilization in the United Kingdom; Quality control and beneficiation of fly ash; Establishing a market for lime-fly ash base; Laboratory evaluation of fly ash and other pozzolans for use in concrete products; An industrial evaluation of fly ash bricks; Lightweight aggregates in the United States; Properties of lightweight sintered aggregate from some Yugoslav lignite fly ashes; Research in the area of fly ash; Fly ash utilization in the treatment of polluted waters; The new fly ash; Ash from lignite; Beneficiation of fly ash; Fly ash as a fertilizer; Test firing of fly ash brick on a short time cycle; Fly ash utilization in the United Kingdom; and Protecting our environment.

A QUICK SETTING SILICO-PHOSPHATE CEMENT

Monsanto Research Corporation. Richard J. Janowiecki, and Charles E. Semler. January 1971, 144 pages.

PB–199 429

Cements with setting times less than those available with Portland cements are desirable for rapid patching of concrete pavements with a minimal disruption of traffic. Silico-phosphate cements based on wollastonite (a naturally occurring calcium silicate) dissolved in buffered phosphoric acid have now been found to possess certain properties which make them significantly better for quick patching applications than Type III Portland cement. The setting times of these cements can range from minutes to hours, and their compressive strength after curing hours is greater than that of conventional cements after days. The document reports the results of a program to optimize and completely characterize wollastonite cements, with and without additives. The data provided include those involving the heat evolved during mixing and setting, compressive strength after long term wet and dry curing and after freeze-thaw and thermal cycling, tensile strength, thermal expansion, adhesion of cement to concrete, and other properties.

UTILIZATION OF PHOSPHATE SLIMES

International Minerals and Chemical Corporation. Srini Vasan. August 1971, 141 pages.

PB–203 191

Phosphate slimes are a waste byproduct of the phosphate mining industry. The water retentive characteristics of the clays which are mined with the rock may be such that there is more volume of phosphate slime to dispose of than there is actual rock mined. It has now been found feasible to produce a pelletized light weight aggregate and ultimately a light weight concrete from the slimes. The production methods and equipment are described in the report. The feasibility of producing other potential products, such as ceramic tile, pipe, and brick, was technically confirmed.

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DRY-PRESSED BUILDING BRICKS FROM COPPER MILL TAILINGS

Bureau of Mines. P. G. Pigott, E. G. Valdez, and K. C. Dean. July 1971. 17 pages.

PB–203 651

In milling low-grade copper ores to produce a smelting-grade concentrate, enormous tonnages of finely ground tailings are discarded. An investigation revealed that these wastes could be used to make dry-pressed building bricks. This would eliminate the need for digging new pits for brick raw material production and also conserve natural resources. The document provides details on the manufacture of facing bricks. Statistical data are given on the economics of brick production and marketing.

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Corrosion

CORROSION PROTECTION OF MAGNESIUM AND MAGNESIUM ALLOYS

Battelle Memorial Institute, Defense Metals Information Center. Earl L. White, and Frederick W. Fink. June 1965. 41 pages.

AD–469 906

The corrosion resistance of magnesium alloys in many natural environments is in the same range as that of iron and plain carbon steels. Thus, some type of corrosion protection is often necessary, and the protective measures often involve some type of coating system. In addition to the general corrosion problem, magnesium can suffer accelerated attack when coupled, in the presence of a conducting electrolyte such as seawater, to most metals below it in the galvanic series. A number of coating systems have been proposed and used satisfactorily. Depending on the application, these systems include the use of conversion coatings, organic coatings, metallic coatings, and others. In addition, special designs can be employed to improve the overall corrosion resistance of the systems. This document describes many of the coating systems and design methods which can be used to reduce corrosion attack on both galvanically coupled and uncoupled magnesium assemblies. A bibliography of 199 entries is included.

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CORROSION OF TITANIUM

Battelle Memorial Institute Defense Metals Information Center. J. D. Jackson, and W. K. Boyd. September 1966. 51 pages.

AD–803 701

The use of titanium has grown remarkably since it first achieved commercial status in the early 1950's. This usage has resulted largely from the high strength-to-weight ratio and good corrosion resistance of titanium and its alloys. This document summarizes information that has become available since 1960 on the general corrosion behavior of these metals. It points out those service applications where the use of titanium is likely to be limited, as well as many applications where its use has been quite successful. The document also identifies certain media and conditions under which stress corrosion cracking has been observed in titanium and/or titanium alloys.

THE ROLE OF DESIGN IN CORROSION PREVENTION

Battelle Memorial Institute. Lyle D. Perrigo. 1971. 33 pages.

BNWL–SA–3817

During the design of various systems, buildings, and equipment, action should be taken to avoid corrosion problems in subsequent periods of operation by proper specification of materials and the use of anti-corrosion design principles. The former is a common consideration in most design efforts; the latter is equally important but frequently receives little attention. The document expounds a design philosophy wherein the application of common anti-corrosion measures and techniques will reduce corrosion losses. Consideration is given to the use of orientation, layout, and configuration to avoid holdup of solutions, abrupt flow changes, impingement, and stagnant areas. It is emphasized that climatic conditions and terrain are important factors in selecting sites so as to minimize atmospheric corrosion of buildings and equipment.

Metals and Alloys

MECHANICAL AND PHYSICAL PROPERTIES OF INVAR AND INVAR-TYPE ALLOYS

Battelle Memorial Institute, Defense Metals Information Center. William S. McCain, and Robert M. Maringer. August 1965. 77 pages.

AD–474 255

The need to eliminate or minimize the effects of temperature on elasticity and on the dimensions of precision-instrument components has led to the development of a host of alloys which display the "Invar Effect." Most of these are basically iron-nickel alloys which display unusual temperature dependencies of the thermal expansion and/or thermoelastic coefficients. This document describes the compositions and properties of the most useful of these alloys, principally those which exhibit a constant modulus of elasticity or a very low thermal expansion over a significant temperature range. Specific alloys discussed include: Invar, Super Invar, Stainless Invar, Elinvar, Ni-Span-C, Isoelastic, Vibralloy, and a number of experimental alloys. A bibliography of 207 entries is included.

HIGH-PURITY METALS

Battelle Memorial Institute, Defense Metals Information Center. George W. P. Rengstorff. January 1966. 75 pages.

AD–480 455

A review is provided of production techniques, known purities, and availability of high-purity molybdenum, tungsten, niobium, tantalum, rhenium, beryllium, titanium, iron, nickel, chromium, vanadium, zirconium, and boron. Information about the purest available polycrystalline and single crystal forms of each of the elements is presented, together with information about less pure forms such as those usually considered commercially pure. In view of current emphasis on the need to fully characterize high-purity metals for research studies and for some applications, a discussion is included of some of the newer techniques for analyzing the purity of the metals. A bibliography of 196 entries is also included.

TRENDS IN USAGE OF CHROMIUM

National Materials Advisory Board. May 1970. 100 pages.

AD–707 175

A report is made on the sources, importance, and uses of the metal chromium. For example, there is no adequate replacement for chromium in corrosion, oxidation-resistant, or high temperature alloys; stainless steel cannot be made without it. World resources of chromium are reviewed, including grades of chromite ore from Russia, Turkey, Rhodesia, South Africa, and the Philippines; applications are cited in metallurgical, chemical, and refractory engineering; stockpiles, supply levels, and predictions of availability are noted. A discussion is included of industrial needs, including tool steels, heat resistant materials, and possible substitutes for chromium chemicals. Statistical summaries and recommendations are given.

EMBRITTLEMENT

Defense Documentation Center. June 1970. 95 pages.

AD–708 700

Embrittlement, a condition wherein metals lose their impact toughness, can be caused by low temperatures, heat treatment, or the presence of impurities. This indexed bibliography, covering the period January 1953–March 1970, contains summaries of 72 research reports funded by the United States Government. The reports listed are available from NTIS.

ENGINEERING DATA ON NEW AND EMERGING STRUCTURAL MATERIALS

Battelle Memorial Institute. O. L. Deel and M. Mindlin. October 1970. 270 pages.

AD–720 278

Considerable search is being made for alloys which have satisfactory mechanical properties at high temperatures. An evaluation of some newly developed structural materials is reported, using data from a literature survey combined with the results of tests conducted to fill gaps in the existing information. Tabulations are included for convenience on the properties of specified alloys of titanium, aluminum, and nickel with other metals. The effort covered in the report is concentrated on 6A1–4V and Beta 3 titanium alloy sheet, AF2–IDA heat-resistant alloy bar, Beta C and 5621–S titanium alloy forgings, 300M high-strength steel forging, 7178–T76 aluminum alloy sheet, 7049–T73 aluminum alloy hand forging, 6A1–4V titanium alloy extrusions, 7175–T736 an aluminum alloy die forging, and MP35N high-strength bar. The mechanical properties investigated include tension, compression, sheer, bend, impact, fracture toughness, fatigue, creep, stress-rupture, and stress corrosion at test temperatures.

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CRACK PROPAGATION AND ARREST IN SHIP AND OTHER STEELS

Battelle Memorial Institute. G. T. Hahn, R. G. Hoagland, P. N. Mincer, A. R. Rosenfield, and M. Sarrate. August 1971. 63 pages.

AD–731 674

In ship construction the trend toward higher strength steels and more highly stressed hulls makes fracture behavior increasingly critical. In addition to failure from flaws, detection of which has increasingly improved, failure may result from the propagation of cracks in regions of low toughness such as welds. Accordingly considerable attention is being directed toward crack control. The report describes a three part investigation into fracture mechanics covering the major stages of initiation, propagation and arrest. To study the problem in detail a wedge-loaded double-cantilever beam design was used because of its crack arrest capability. Much of the experimentation was done on Fe–3Si steel where crack-tip yielding can be revealed by etching. Test methods are described and the results are discussed in relation to obtaining a framework for arrest criteria for steels in general and ship steels in particular.

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EFFECTS OF SURFACE CONDITION ON THE MECHANICAL PROPERTIES OF TITANIUM AND ITS ALLOYS

Battelle Columbus Laboratories. Metals and Ceramics Information Center. D. N. Williams and R. A. Wood. August 1971. 73 pages.

AD–732 248

The report reviews the available literature on surface treatments for titanium and its alloys and on the effects of both intentionally and unintentionally induced surface phenomena on the properties of these metals. The material properties of major concern include fatigue strength, tensile strength and ductility, and bend ductility. The surface conditions considered include those created by surface contamination by oxygen, nitrogen, carbon, hydrogen, and metallic contaminants; nitrogen and oxygen hardening; anodized, metallic, and ceramic coatings; metal-enriched surfaces; mechanical surface treatments; and surface finishing.

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CHROMIUM AND ITS ALLOYS

Battelle Memorial Institute. Defense Metals Information Center. D. J. Maykuth, and A. Gilbert. October 1966. 127 pages.

AD–810 530

The major reason for interest in chromium as a structural material lies with its combination of high melting point, low density, and moderately good oxidation resistance, especially as compared with iron, cobalt, and nickel. Much of the progress on which current chromium alloy hopes are based has occurred since 1958. This report seeks to assess these developments. Attention is given to general metallurgical considerations, available forms, consolidation methods, fabrication, hardness and recrystallization behavior, physical properties, mechanical properties, oxidation behavior, thermal shock resistance, machining, and joining. A bibliography of 173 entries is included.

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FORMING OF TITANIUM AND TITANIUM ALLOYS

Battelle Memorial Institute Defense Metals Information Center. Daniel E. Strohecker. September 1967. 69 pages.

AD–819 457

Many of the earlier difficulties in the fabrication of titanium with conventional metalworking equipment have been overcome through the introduction of new metal processing equipment specifically designed for forming titanium. The report provides a review of the use of the following techniques in conjunction with this equipment: Brake forming, stretch forming, deep drawing, trapped-rubber forming, tube bulging and bending, drop-hammer forming, roll forming and bending, spinning and shear forming, dimpling, joggling, and hot sizing. In addition, auxiliary metalworking operations, preparation for forming, blank heating methods, lubricants for forming, and tooling materials are discussed.

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APPLICATIONS OF NICKEL

Materials Advisory Board. December 1968. 115 pages.

AD–846 999

Production and consumption of nickel have nearly doubled in ten years time; however, production of the metal has tended to lag behind needs. For this reason, an examination was made of current applications and projected growth of major uses of nickel, together with the possibilities of substituting more plentiful materials where the situation should warrant. The results are discussed under the following headings: World nickel resources; Production forecast; Flexibility of supply; Stockpile activities; Usage by alloy types; Usage in selected applications (electroplating and chemicals, aeronautical and marine applications, industrial turbomachinery, automotive applications, coinage, batteries).

USAGE OF TITANIUM AND ITS COMPOUNDS WITH COMMENTS ON SCRAP AND SPONGE

Materials Advisory Board. February 1969. 116 pages.

AD–848 925

The purpose of the report is to define the present and anticipated applications of titanium. Attention is also given to possible substitutes for this metal. Topics include: Titanium usage in airframes and aircraft engines; non-aerospace uses of titanium; titanium for desalination equipment; new application possibilities; titanium scrap; titanium sponge metal; titanium dioxide and other titanium-containing compounds.

EVALUATION OF PROCESSING TECHNIQUES FOR PRODUCING PREMIUM QUALITY, HIGH STRENGTH ALUMINUM ALLOY CASTINGS

Northrop Corporation. K. J. Oswalt. December 1968. 293 pages.

AD–851 879

The availability of premium quality cast structures provides design flexibility and efficiency previously unobtainable by conventional materials and processes. In particular, the development of cast lightweight alloys with wrought metal properties is a significant accomplishment of the past several years. Previous studies have shown that cast A1–Cu–Ag alloys have unique high-strength properties and ductility. An effort was therefore directed toward the development of design property data and specification documentation for immediate application of this family of alloy castings. The report provides a review of alloy and casting technology; a review of published information concerning the casting of these alloys; a description of procedures in the sand casting and testing of complex shapes from the alloy; the results of a statistical evaluation of tension, compression, shear, and bearing room temperature mechanical properties of the alloys; and a tabulation of casting design allowable properties.

THE NBS ALLOY DATA CENTER: PERMUTED MATERIALS INDEX

National Bureau of Standards. G. C. Carter. D. J. Kahan. L. H. Bennett. K. R. Cuthill, and R. C. Dobbyn. March 1971. 688 pages.

COM–71–50070

The Index contains literature references to approximately 10,000 research papers on the physical properties of metals and alloys, with listings by journal, volume, page, and year. Categories included are electronic transport properties, magnetic properties, mechanics, nuclear and other resonance properties, quantum description of solids, electromagnetic radiation, superconductivity, thermodynamics, and soft x-ray spectroscopy. Also included are related topics such as susceptibilities, specific heats, hyperfine fields, and band structures. In the permuted materials index alloys are listed and cross referenced under each of their constituent components.

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DEVELOPMENT OF HIGH-TEMPERATURE VANADIUM-BASE ALLOY

Bureau of Mines. G. H. Keith and J. S. Winston. June 1970. 17 pages.

PB–192 301

The search for heat and corrosion resistant materials has led to the investigation of many of the lesser known or rarer metals and their alloys. A report is made on the attempt to develop a vanadium base alloy with strength properties equal or superior to those of nickel and cobalt base superalloys at both ambient and elevated temperatures. Following a literature review, combinations of vanadium, titanium, carbon, and yttrium, molybdenum, and silicon were considered promising. A total of 33 alloys of these elements was produced and tested. A vanadium alloy with exceptionally high strength at temperatures up to 1200C was developed.

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COLUMBIUM ALLOY DEVELOPMENT WITH BORON, HAFNIUM, AND TUNGSTEN

Bureau of Mines. Herbert R. Batitzke, L. L. Oden, and H. J. Kelly. June 1970. 34 pages.

PB–192 416

Columbium (or niobium), a metal which is relatively new to industry, is receiving current attention because of its high-temperature strength, ductility, and chemical inertness. Since it possesses poor oxidation resistance at high temperatures, improvement is sought through alloying with other metals. An investigation is reported in which hafnium, tungsten, and boron were used as strengthening materials. Certain of the alloys exhibited strengths of 29,000 psi at 1200 deg C. The ternary alloy Cb–15Hf–5W was the most resistant to oxidation.

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TRENDS IN THE USAGE OF BISMUTH

National Materials Advisory Board. August 1970. 45 pages.

PB–194 493

Bismuth, useful in low melting point alloys, metallurgical additives, pharmaceuticals, and specialized applications, is obtained largely as a by-product from the ores of other metals, principally copper and tin. The report describes the current availability of the metal on a world-wide basis, and patterns of its usage. Projections of utilization are made to 1973, and consideration is given to the effect of substituting other materials for bismuth. Data on mining, exports, and imports in various countries of the world are tabulated, with comments regarding the industrial future of bismuth.

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PROCESSING MANGANIFEROUS SEA NODULES

Bureau of Mines. P. T. Brooks, and D. A. Martin. January 1971. 23 pages.

PB–197 024

Much of the information on the industrial possibilities of calcareous and siliceous nodules which occur on the sea bottom are speculative rather than definitive. Since these mineral nodules represent a vast potential source of manganese, nickel, cobalt, and copper, there is interest in the development of technology to utilize them. The report contains an evaluation of alternative processing methods to recover pea to football size cryptocrystalline nodules from the ooze of the Pacific and Atlantic Ocean floors. Included are discussions of sulfation by roasting, leaching, and combined processes. Indications of the feasibility of the various systems are given.

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A NEW INTERNAL OXIDATION PROCESS FOR STRENGTHENING TUNGSTEN

Bureau of Mines. R. Blickensderfer, M. I. Copeland, and W.L. O'Brien. June 1971. 40 pages.

PB–201 888

Metallurgists have long anticipated that tungsten would prove the answer for material needs at high temperatures because of its high melting temperature. The present work was undertaken to develop new methods for strengthening tungsten with emphasis placed on dispersion strengthening. Tungsten alloys with high-temperature strength properties, comparable to the best of alloys recently developed by others, were produced by a new process called here the oxyreaction process. The process involved additions of a powder of a reactive metal compound, ZrN, ZrW_2, or HfW_2, to a base metal powder, tungsten, which contained some oxygen. The powders were blended, compacted, sintered, and extruded. The oxyreaction process circumvents many of the agglomerating and coarsening problems encountered in the current methods for dispersing a stable oxide in a metal.

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CREEP AND OTHER PROPERTIES OF EXTRUDED ZINC-30 PERCENT ALUMINUM ALLOYS CONTAINING ALUMINUM

Bureau of Mines. L. A. Neumeier, and J. S. Risbeck. 1971. 32 pages.

PB–203 652

Previous work in a program to develop improved zinc alloys, which can serve as substitutes for alloys of copper and aluminum, is reported in PB–190 971 and PB–200 703 (see AMTID, January 1972, page 23). From the standpoint of their overall tensile properties, zinc alloys containing 30% Al and 0 to 0.7% Mg were chosen for further evaluation, as reported in this document. They have been found to be amenable to extrusion either above or below their eutectoid transformation temperature. Furthermore, they can display good creep resistance coinciding with high tensile strength and useful ductility, when processed with certain conditions. The overall properties of the Zn–30Al–Mg alloys make them superior to conventional zinc alloys in a number of applications.

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TRENDS IN THE USE OF DEPLETED URANIUM

National Materials Advisory Board. June 1971. 184 pages.

PB–203 685

The primary purpose of this report is to present information on uranium and its compounds that will assist in the assessment of the impact of changing technology on future requirements for uranium materials. Furthermore, it is hoped that the report will establish uranium as a potential raw material and thus stimulate greater interest in research and development, which could lead to the realization of new and more extensive usage of depleted uranium in non-nuclear applications. The major source of uranium for this use is the increasing quantity of depleted uranium being generated as a by-product of government and industry nuclear energy applications. Topical areas covered in the report include depleted uranium's supply situation, present nonenergy consumption, potential uses, metallurgy, chemistry, and effectiveness as a catalyst and alloying element.

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THE DEVELOPMENT OF MELTING AND CASTING PROCEDURES FOR NITINOL NICKEL-BASE ALLOYS

Battelle Memorial Institute. D. C. Drennen, C. M. Jackson, and H. J. Wagner. December 1968. 33 pages.

SC–CR–69–3070

Nitinol, an alloy containing 55 wt.% nickel and 45 wt.% titanium, is a unique engineering material inasmuch as it possesses a so-called "shape memory" which enables it to return to a prefixed shape after being plastically deformed and then reheated to its transition temperature. Another feature of the alloy is that it possesses a very high damping capacity (similar to that of the better Mn–Cu alloys) below its transition temperature, but an extremely low damping capacity (like a bell material) above this temperature. Some possible applications of the "shape memory" of Nitinol include temperature-sensitive switches, mechanical-work devices, and blind fasteners. The report covers the development of melting and casting procedures for Nitinol alloys, and the preparation of material with certain specific transition temperatures. It was found possible to obtain large, high-quality ingots and smaller rod castings of Nitinol. The ingots are considered to be prime material for working into strip and wire. A curve illustrating the dependence of the transition temperature on composition is given.

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FRACTURE TOUGHNESS OF LOW-STRENGTH STEELS

Bettis Atomic Power Laboratory. D. J. Seman, G. P. Kallenberg, and R. J. Towner. May 1971. 143 pages.

WAPD–TM–895

The document is concerned with general fracture mechanics concepts, with particular reference to the fracture toughness of low-strength steels. Data from experimental investigations and a literature search are summarized, with an analysis with respect to technical advances in the state of the art. Parameters reported on include specimen dimensions and testing conditions necessary for valid plane-strain fracture-toughness measurements and loading rate determinations. The data include both static and dynamic loadings. Irradiated materials tests, and tests of weld and heat-affected-zone materials are included. Four grades of steel are covered.

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Miscellaneous Materials

DEVELOPMENT OF MULTIPURPOSE CAPSULAR ADHESIVE SYSTEMS

National Cash Register Company. C. K. Schaab, R. D. Hilbelink, G. H. Peters, T. R. Davis. October 1970. 63 pages.

AD–730 908

A unique, polyesterepoxy adhesive system was developed which cures very rapidly upon mixing of its two components and adheres to a multitude of substrates under various environmental conditions. Each of the two liquid adhesive components can be encapsulated to form "pseudo solids". Mixing together of the two capsular components into the proper ratio forms a stable, "one can," dry powder adhesive that is easily activated upon rupture of the capsules. The report describes this rapid curing capsular adhesive system, with its improved stability, handling and logistic characteristics due to encapsulation. Capsular adhesive stability was found to be nine months under laboratory conditions with the epoxy component being the limiting factor. Several formulation variations were made that affected cure time, bond strength and adhesion properties. Encapsulation of each of the two components was easily scaled up through the pilot-plant stage. Several mechanical adhesive applicator designs were developed and evaluated for the extrusion and application of both the capsular adhesives and the same formulations in their liquid, unencapsulated forms.

PROCESS AND APPARATUS FOR MAKING DIAMONDS

National Aeronautics and Space Administration. J. R. Rasquin, Marvin Estes, and David Webb. September 1970. 22 pages.

N71–23775

The interest in the production of industrial diamond abrasives has increased throughout the world as the level of technology has advanced. Diamond is unique as an abrasive. Its hardness and cutting ability are unrivaled by any other substance. Its major drawback is its expense. The paper describes a novel and inexpensive method of producing shock in graphite to synthesize diamonds without the use of high explosives. The diamond grit produced by the method is polycrystalline in nature and is of sizes typically used for grinding and lapping processes.

THERMAL INSULATION: A COMPILATION

National Aeronautics and Space Administration. 1970. 14 pages.

N71–30851

A number of thermal insulation designs and materials developed by or for NASA have potential applications outside of the aerospace industry. The document presents innovative concepts, insulation systems and components, and applications of thermal insulation. A form for requesting additional technical information is included.

MINERAL FACTS AND PROBLEMS, 1970 EDITION

Bureau of Mines. 1970. 1,251 pages.

PB–203 077

The reference manual gives up-to-date information on the important minerals, including metals, nonmetals, and fuels. Individual commodities are covered separately under such topics as industry patterns, technology, present and future conditions, reserves, supply-demand relationships, byproduct-coproduct relationships, consumption patterns, economic factors, and environmental considerations. The outlook for each mineral is projected to the year 2000. Both fossil fuels and nuclear materials are included. Such substances as asbestos, corundum, clay, stone, mica, and gypsum are also covered.

Plastics and Elastomers

SURVEY OF PLASTICS SANDWICH CONSTRUCTION

Plastics Technical Evaluation Center. Nicholas T. Baldanza. May 1968. 104 pages.

AD–673 713

Sandwich construction usually consists of two outer thin sheets, called faces or skins, bonded to an intermediate thick layer of low density, called the core. This document provides a survey of sandwich constructions employing plastics. It contains technical information and references that should give the designer and materials engineer a better understanding of the potential usage of these techniques. Consideration is given to specifications, various types of sandwich facings and core components, adhesives, sealants, fasteners, and other topics.

LITERATURE SEARCH: INJECTION MOLDING PROCESSING PARAMETERS

Plastics Technical Evaluation Center. Nicholas T. Baldanza. July 1969. 36 pages.

AD–703 530

Injection molding of plastics is a method of driving a crystalline or amorphous polymer under controlled conditions of pressure and temperature through a nozzle into a cavity. The document discusses experimental data on, and evaluates the factors affecting, the flow of a plastic within an injection mold, with particular attention to ram speed rate and characteristics of melts. A state-of-the-art review covers a variety of topics of concern, including injection pressure, mold and melt temperature, molding cycles, flow rate, thermal and shear stresses, melt viscosity, internal stresses, warpage, and shrinkage. A discussion is given of instrumentation and methods of testing the molded parts. The relation between processing parameters and the physical and mechanical properties of the finished product is discussed.

SPECIFIC PERMEABILITY OF EPOXY RESIN SYSTEMS

Army Missile Command, Ground Equipment and Materials Directorate. James L. Parham. June 1971. 22 pages.

AD–726 930

It has been well established that fiberglass composites are highly susceptible to environmental degradation. In fact, severe degradation has been observed in composites exposed to high relative humidity conditions at moderate temperatures. Many observers believe this degradation is caused by entrance of moisture and subsequent corrosion of the reinforcement and degradation of the glass-resin interfacial bond. Various techniques previously have been tried in efforts to inhibit this degradation from moisture. In the present study, several types of coatings and filler materials were evaluated for their effectiveness in reducing moisture permeability of epoxy resins. Only the metallic coatings gave significant reductions. The specific permeability of a number of epoxy resin systems is given at room temperature and 140 degrees F. Data are presented on the effects of post cure, curing agent concentration, and specimen thickness on specific permeability.

DEVELOPMENT OF ELASTOMER HAVING LOW WATER-VAPOR TRANSMISSION RATE

Army Weapons Command. Research Directorate. J. A. Williams. August 1971. 22 pages.

AD–731 188

The resistance of elastomers to the penetration of gases, vapors, and liquids is an important factor in their use. Whether low or high resistance to the penetration of gases and liquids is desired is dependent upon the application of the material. In tire inner tubes, low permeability to air is desired; whereas, in the water-purification systems, high permeability to water and resistance to the penetration of other substances is needed. The effect of various types of fillers on reducing the water-vapor transmission rate (WVTR) of vulcanizates of ethylene propylene terpolymer rubber was determined. Carbon-black and most nonblack fillers produced only a small reduction in the WVTR, whereas platelike mica fillers produced significant reductions. Ethylene propylene terpolymer/butyl rubber blends containing 50 pphr of carbon black produced vulcanizates with good physical properties and low permeability to moisture. The formulations of these systems are given.

CROSSLINKING-EFFECT ON PHYSICAL PROPERTIES OF POLYMERS

Monsanto Research Corporation. Lawrence E. Nielsen. May 1968. 46 pages.

AD–834 683

Many of the polymers used in composite systems and in other applications are crosslinked or thermoset polymers. In addition to vulcanized rubbers, typical crosslinked polymers include: phenol-formaldehyde resins, melamine resins, crosslinked polyester resins, and epoxy resins. A review is made of the theoretical and experimental results of the effect of crosslinking on the physical properties of polymers. Both rubbers and rigid polymers are considered. Topics covered include: Types of network structures, methods of characterizing crosslinked polymers, swelling behavior, glass transitions, elastic moduli and dynamic mechanical properties, creep, stress-strain behavior, thermal properties, and anisotropic networks. The review is written from the practical viewpoint of the experimental scientist who is using crosslinked polymers but who is not an expert on the theory of crosslinking.

Wood and Paper

AIR DRYING LUMBER IN A FORKLIFT YARD

Forest Products Laboratory. Raymond C. Reitz. April 1970. 18 pages.

AD–706 087

The objective of the air-drying process is to reduce the moisture content of the lumber to a value consistent with climatic conditions, or to a shipping condition, in the shortest time and with the least number of drying defects. Handling and transporting lumber in packages with forklift trucks have resulted in major changes in the layout and operation of air-drying yards. This report describes how these changes have affected the drying time and degrade of lumber. Illustrations are provided of various storage arrangements in air-drying yards.

MEASURING SHRINKAGE IN HANDSHEETS DURING DRYING

Forest Products Laboratory. Gary C. Myers. May 1970. 17 pages.

AD–707 287

Water is needed to carry the pulp fibers through all stages of processing and refining before delivering them to the paper-machine wire. However, when the fibers are deposited on the wire, water must be extracted from the web. The extraction of water causes the paper web to shrink. The report describes the measurement of the reduction in thickness and width and the simultaneous increase in shrinkage force that occur while a strip of paper is dried. The effect of fiber bonding on shrinkage is noted.

SOME STRESS-GRADING CRITERIA AND METHODS OF GRADE SELECTION FOR DIMENSION LUMBER

Forest Products Laboratory. R. L. Ethington. December 1970. 17 pages.

AD–715 991

The grading of lumber for stress qualities is important to the economics of construction, since costs can be greatly reduced by selection of serviceable woods from lower cost categories. Bending strength and tensile strength have been found to be closely related to modulus of elasticity and strength ratio, so that stress-grading lumber involves research on limitations in the ability of certain grades to insure the required bending stress. The document discusses machine grades, grading methods, and procedures for selecting grades in consideration of the performance required. Considerable data are presented for 2 by 8 floor joists with a given knot limitation, as obtained by regression analysis.

PROPERTIES OF TROPICAL WOODS

Yale University. Frederick F. Wangaard. December 1969. 10 pages.

AD–716 400

In the expanding search for sources of wood to offset dwindling supplies in some areas and to exploit the characteristics of wood varieties hitherto not explored, attention is being directed to the forest products of tropical regions. A literature review is provided on the characteristics of tropical woods, including gluing characteristics, weathering characteristics, stress, fiber, and chemical resistance characteristics, mechanical behavior under cyclic loading, decay resistance, veneer applicability, laminates and wettability, water-vapor sorption, and allied topics. Study of structure, composition, density, and behavior characteristics are aimed at providing a useful contribution to wood science and technology.

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GRADING HARDWOOD LUMBER BY COMPUTER

Forest Products Laboratory. Hiram Hallock, and Lynn Galiger. July 1971. 16 pages.

AD–728 958

The nonhomogenous nature of wood in logs, involving variations in physical properties and in quality as affected by such defects as knots and splits, has restricted efforts to update processing techniques. One system of improvement is discussed, in which a computer program is used in automating the lumber grading system in a sawmill. This program simulates the decision making progress for several hardwoods, this type of wood being chosen because it is more mathematical in nature than the softwood. The objective is to determine the location of cuts to produce boards from flitches, avoiding defects, and grading quality, in minimum time. Optimization is thereby gained at the edger and trimmer in the sawmill. Subroutines are described which determine cutting and overlapping possibilities; and grading aspects are noted as the computer sees them.

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IMPROVEMENTS IN SOLAR DRY KILN DESIGN

Forest Products Laboratory. Eugene M. Wengert. 1971. 10 pages.

AD–730 952

Drying of lumber in translucent kiln structures by means of solar energy is receiving increased attention in view of the increased efficiencies involved, including shorter drying time, lower moisture content, less lumber degrade, and lower cost, as compared to air kiln drying methods. The report examines possible means of rectifying some present weaknesses in the solar kiln method, beginning with theory and analysis of the solar dryer, and leading to means of reducing energy losses presently inherent to the system. Data were obtained on temperature changes of all materials within the kiln, on liquid to vapor changes within the wood, convection losses from the walls and floor, ventilation shortcomings and improvements, and reflection and transmission of the solar energy in addition to losses by longwave radiation. Conclusions are drawn from results obtained by instrumentation.

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FEASIBILITY STUDY ON THE RETRIEVAL AND USE OF PRIMARY WOOD RESIDUE

West Virginia University. J. W. Schmidt Jr., W. D. Torlone, J. Byrd, and M. R. Fedorko. February 1970. 259 pages.

PB–191 101

Research was undertaken to study the feasibility of removing and utilizing wood waste left in a forest after primary logging operations have been completed. Regardless of its intended use, the feasibility of using primary wood waste hinges largely on the cost of removal and the cost of the processing necessary to convert the raw product into a more easily handled and useable form. The major thrust of the research was directed toward an analysis of these costs. The criterion of feasibility is the cost of removal and processing compared with the return to be realized as a result of recovery. Primary waste refers to wood residue left in the forest in the form of tops, limbs, broken and cull logs, and cull trees. Studies over the past twenty years have underscored the fact that large volumes of such residue are left in the forest as waste after logging operations are completed. The use of this waste was found to be feasible only if retrieval and transportation costs are low, or if the wastes can be ground on site to unbarked chips which in turn can be sold at a price high enough to cover costs.

MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

Bonding and Joining

WELDING HIGH-STRENGTH STEELS

Battelle Memorial Institute. Defense Metals Information Center. P. A. Kammer, and D. C. Martin. July 1966. 60 pages.

AD–488 837

Recent developments in the welding of steels with yield strengths greater than 150 KSI have been concerned primarily with applications which require plate thicknesses greater than ½ inch and which preclude a complete postweld heat treatment. Four general classes of steels have received attention: Low alloy martensitic steels; medium-alloy martensitic steels; nickel maraging steels; and bainitic steels. This report reviews developments in this area, points out major areas for future study, and projects the future status of welding high-strength steels.

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DIFFUSION BONDING

Defense Documentation Center. August 1970. 79 pages.

AD–710 500

The bibliography is a compilation of abstracts of U.S. Government funded reports in the field of diffusion bonding. Subjects treated include better protection for surfaces subject to erosion, corrosion and wear at high temperatures, water debonding of resins to glass, remelt testing procedures, ultrasonic scanning, and low temperature diffusion treatment. Devices covered are electron tubes and transistors, nozzles and marine hulls, tungsten joints, and applications of liquid metals. Processes included are vacuum diffusion welding, automatic arc welding, solid state diffusion welding, thermocompression bonding, and treatment of special structural alloys. Joining methods include alumina ceramics to alloys, titanium to copper, aluminum to steel, and similar combinations. Attention is given to shear strength and joint strength. Other topics include brazing, sandwich construction, honeycomb cores, and composite materials. The reports listed in the bibliography are available from NTIS.

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BRAZING (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. October 1970. 80 pages.

AD–714 000

The bibliography is a compilation of summaries of U.S. Government funded reports on brazing. Methodologies covered include low temperature brazing, sandwich construction and honeycomb cores, soldering, spot welding, and diffusion bonding. Equipment discussed includes pipe fittings, vacuum apparatus, test equipment, brazing furnaces, and apparatus capable of such joinings as quartz glass to metals. Discussions are given on remelt separation temperature, joint thickness, wettability, microstructure, and costs. Materials considered include stainless steel, beryllium alloys, boron, silicon, platinum, titanium, tungsten, nickel, chromium, aluminum, gold, molybdenum, palladium, ceramics, and compounds. The reports listed are available from NTIS.

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FEASIBILITY STUDY OF REFRACTORY-BASE WELD-BACKING MATERIALS

Army Materials and Mechanics Research Center. George J. Snyder. October 1970. 36 pages.

AD–715 856

In many arc welding operations, the quality of the finished product may depend on the use and characteristics of a supporting weld backing structure for obtaining proper fusion. The document reports on research to develop a low cost moldable refractory base mixture for fabricating ¼ to ½ inch thick preforms of a shape to replicate the desired joint underside contour. An automatic core blowing machine is described for manufacturing expendable weld backing sections of low alloy steel. These preforms serve as supporting cushions for the root bead, especially in arc-side butt-joining operations. Three mixtures of refractory and bonding ingredients are discussed, including olivine, silica, and zirconite, along with other considerations such as mass production and long time storage.

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ARC WELDING (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. March 1971. 72 pages.

AD–722 765

The bibliography is comprised of abstracts of U.S. Government funded research reports on arc welding. Topics covered include welded joints, welding of continuously moving parts, automated methods in construction, alternating current power supply, vacuum welding, ultrasonic spot welding, welding set performance, mathematical models, heat transfer, mechanical properties, and microstructure. Materials include devices of aluminum, beryllium, and copper, 2-inch titanium alloy plate, steel plates, nickel alloys, chromium alloys, molybdenum alloys, maraging steels, and heat resistant metals and alloys. The reports listed are available from NTIS.

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STRUCTURAL ADHESIVE BONDING

Air Force Contract Management Division. Directorate of Quality Assurance. June 1971. 96 pages.

AD–730 628

Structural adhesive bonding is a process of adhering structural parts together by means of an adhesive material to create joints stronger than the material joined; it includes metal-to-metal bonding such as plates to panels, metal-to-core bonding such as honeycomb core constructions, and reinforced plastic laminate fabrication. The document is concerned with metal-to-metal and metal-to-core bonding, and discusses failure modes, failure analysis, and flaw detection. A discussion is made of manufacturing technology, including types, composition, and properties of adhesives; filler characteristics; storage properties and limitations of materials; primers; honeycomb components and methodology; preparation and assembly; tooling; voids and human error; and quality control. Of particular concern is the detection and results of anomalies. Methods of inspection and testing, including autoclaves, ultrasonics, and holography are treated in detail. Indications are given for improving the detection process.

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PERCUSSIVE ARC WELDING FOR ELECTRICAL ASSEMBLIES

Bendix Corporation. Edward R. Cheramy. September 1969. 23 pages.

BDX–613–126

In percussive arc welding, the two pieces to be joined serve as electrodes for the arc. They are mounted a predetermined distance apart, the arc is fired (causing melting of the electrode surfaces), one of the workpieces is thrust toward the other by the actuator, and the arc is extinguished on contact. The continuing thrust splashes the molten material outward, thus cleaning the surfaces, and forges the workpieces together. Extremely strong welds are obtained using dissimilar materials. It has been found that percussive arc welding provides a dependable, high-temperature bond between stranded copper wire and the connector pins of electrical assemblies. Additional applications for production include joining stranded wire to metal plates such as chassis frames. The report describes the percussive arc technique as used in the above applications at Bendix. Topics include: Equipment, materials, weld schedules, argon gas cover, isostrength tables, machine settings, free-length effect, and construction of actuator characteristic charts.

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FLOW SOLDERING AND SUPPORTING PROCESSES

Bendix Corporation. W. F. Moyle. May 1971. 116 pages.

BDX–613–330

In view of the fact that commercial soldering machines and associated process control features have been considerably improved since the early 1960's, an investigation was conducted to evaluate the application of flow-soldering techniques to the fabrication of printed-wiring board assemblies. The investigation included all parameters that involve flow-soldering equipment, processes, and board conditions which could affect a flow soldered assembly. The results indicate that this technique is a suitable process for many types of printed circuit-boards, and that its use will increase production rates on those assemblies for which it is suited. The methods of determining and maintaining solderability, the cleaning methods, the ultrasonic tinning process, the methods of preforming and retaining component leads, and the printed circuit-board layout and path configuration features resulting from the project can be applied beneficially to virtually all printed circuit-board assemblies, regardless of the method of soldering used.

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PERCUSSIVE-ARC VERSUS PULSE-ARC WELDING

Bendix Corporation. D. L. Hollar. May 1971. 27 pages.

BDX–613–395

Although soft soldering provides a satisfactory means of securing a great variety of electrical connections, it is not suited for assemblies which must withstand fairly high temperatures and/or where joint strength is important. In addition, many designs require the use of metals that are not solderable by conventional soft soldering methods. Of the alternatives to soft soldering, percussive-arc and pulse-arc welding are considered the most suitable for joining the ends of conductors to terminal pins. This report provides an evaluation and comparison of the two techniques. Consideration is given to process descriptions, acceptable material combinations, applications and advantages, important production parameters, and weld quality assurance methods for each of the two welding processes.

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PARALLEL GAP WELDING

National Aeronautics and Space Administration. A. M. Pasciak. September 1969. 40 pages.

N70–38147

Parallel gap welding, a resistance welding process. is one of a number of welding methodologies now being investigated as means for interconnecting electronic components where the interconnections may number as many as 1000 per inch so that new technology is needed. In the process, the materials to be joined are placed under two electrodes which exert pressure upon them, and a high intensity current is utilized. At present, only gold plated alloys of iron, nickel, and cobalt are so welded. The document provides general information on the subject from the fundamentals of parallel gap welding to the connection of gold plated leads of flat pack electronic packages to laminated printed wiring boards, including process control.

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PRACTICAL METHOD FOR DIFFUSION WELDING OF STEEL PLATE IN AIR

National Aeronautics and Space Administration. Lewis Research Center. Thomas J. Moore, and Kenneth H. Holko. July 1971. 25 pages.

N71–30524

A simple and easily applied method of diffusion welding steel plate in air is described. The feasibility of applying this welding method was clearly established for AISI 1020 steel. The procedure does not require a vacuum furnace or hot press. Information was gained on the diffusion welding of a metal having oxides which are unstable at elevated temperatures, and which is directly applicable to steel and other metals which can absorb their oxides during the diffusion welding cycle. The results of the study are believed to have considerable potential in basic industrial applications.

PARAMETERS FOR PRESSURIZED INERT GAS METAL ARC WELDING OF ALUMINUM

Dow Chemical Company. Eldon D. Brandon. October 1970. 38 pages.

RFP–1515

Pressurized Inert Gas Metal Arc, or PIGMA, welding is a relatively new technique which may be used to reduce weld-metal porosity to extremely low levels. Other desirable conditions, such as narrower, more concentrated arc profiles, may be realized. The PIGMA process is essentially the same as gas metal arc welding, except that the arc is enclosed in a pressure chamber. The report provides the results of a study designed to establish the significance of various process parameters in PIGMA welding of aluminum. Specifically, the effects of arc voltage, wire speed, and chamber pressure are given as they affect arc mode and stability, weld appearance, soundness, area, width, penetration, reinforcement, depth-to-width ratio.

A NEW HIGH TEMPERATURE SOFT SOLDER SYSTEM

Bureau of Mines. Alfred E. Schwaneke, Wilbert L. Falke, and Orrin K. Grosser. December 1970. 22 pages.

PB–196 675

The maximum practical operating temperatures for tin-lead soft solders are below 140 C, and the lowest practical brazing or hard soldering temperatures are around 540 C. A new high-temperature solft soldering system has now been developed to fill this "solder gap" for copper, copper alloys, and low-carbon steel. The method is applicable to automobile radiators, home appliances, etc. The system uses a unique sacrificial nickel coating method to promote wetting and spreading of zinc and zinc alloy solders on metallic substrates. The document outlines the salient facts leading to the development of the system, describes some of its capabilities, and provides a list of fluxes and solder alloys.

THE EFFECTS OF WELD GEOMETRY ON THE FATIGUE BEHAVIOR OF WELDED CONNECTIONS

University of Illinois. H. E. Williams, H. Ottsen, F. V. Lawerence, and W. H. Munse. August 1970. 139 pages.

PB–202 567

The report presents a summary of a series of investigations, carried out over a six year period, into the effects of external geometry upon the fatigue life of butt welded joints. Data are provided on the effects of weld profile on fatigue life, and on the stress concentrations caused by the weld geometry. The results of a study of some of the metallurgical aspects of welds are also included.

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Building Technology

MEASURING WATER PERMEABILITY OF MASONRY WALLS

Naval Civil Engineering Laboratory. Harry Hochman. August 1971. 10 pages.

AD–731 353

The permeability of masonry block walls by water is of interest anywhere in the world, and is of especial concern in a semitropical environment subject to driving rains. The document describes and compares two test procedures developed in Hawaii in connection with periods of excessive water permeation of masonry walls, both of which apply a cylindrical reservoir of water to a masonry surface and measure the rate of disappearance of the water into the wall. The Dunwell procedure requires a testing time of three to four days; a new Naval Civil Engineering Laboratory procedure which has proved both reliable and reproducible reduces the time to an hour or less without marring the surface as is necessary in the former method. Details of satisfactory coating systems are given in addition to testing technology for both procedures.

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MANUAL ON DESIGN FOR LOW-COST AND AIDED SELF-HELP HOUSING

Department of Housing and Urban Development. Wolcott C. Waggaman, and J. Robert Dodge. June 1967. 111 pages.

PB–179 385

Reports indicate that fifty and more countries in the world either have active aided self-help housing programs or are experimenting with the system. In order to supply details important in construction, the manual reproduces several examples of new houses designed for aided self-help projects, presenting the materials by means of sketches and analytical tabulations.

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SEISMIC BEHAVIOR OF MULTI-STORY FRAMES DESIGNED BY DIFFERENT PHILOSOPHIES

California University. James C. Anderson and Vitelmo V. Bertero. October 1969. 203 pages.

PB–190 662

Because of the increasing cost of urban land, considerable research is being devoted to the construction of taller buildings, even where high seismic activity is probable or existent. The document is concerned with design philosophy in such an environment, especially with regard to ten-story and twenty-story structures. An examination was made of the behavior of unbraced steel frames proportioned according to three different considerations: conventional allowable stress, strong columns and weak girders, and minimum weight. The assumptions and features for each design philosophy are discussed, along with the equations of motion, mass, stiffness, and damping characteristics, plus stability and energy relations. Loading, earthquake effects, and building types are covered. Some of the effects described are related to ground acceleration and gravity loads. A digital computer was used to determine the nonlinear, dynamic response of the frames to strong ground motion. A suggestion is made for alteration of geometry by varying the yield moment and the rate of strain hardening.

WIND LOADS ON STRUCTURES

National Science Foundation. July 1971. 142 pages.

PB–202 410

Understanding of the wind loading on structures has become increasingly important with the increase in high-rise construction and the trend toward lighter, more flexible structures. Of especial importance is safety and protection engineering in disastrous wind actions. The document reports on the materials presented in a 1970 conference on wind engineering for buildings, under the major heads of public safety and protection, tornadoes and hurricanes, meteorology and climatology, stochastic methods in structure engineering, building structural analysis and design, aerodynamics and aeroelasticity, and test procedures including wind tunnel and full scale investigations. Topics discussed are storm path prediction, wind profiles, mathematical models, environments, static and dynamic force measurement, diffusion and heat transfer, air-sea interactions, metropolitan areas, structure anchoring, waterspouts and cyclones, storm damage, bridges, and ocean structures.

FHA STUDY OF SEISMIC DESIGN CRITERIA FOR HIGH-RISE BUILDINGS

Lin and Associates. Ray W. Clough, and K. Lee Benuska. August 1966. 368 pages.

PB–202 960

Increasing numbers of high-rise buildings are being constructed, even in areas subject to earthquakes. It is essential, therefore, for building design to incorporate earthquake criteria in such regions, in order to provide assurance that buildings will neither collapse nor suffer unrepairable damage. The report describes the results of a three-phase program of study and research into the earthquake behavior of high-rise buildings. The most extensive phase consists of a computer analysis and subsequent evaluation of structural systems subjected to ground motion, particularly with regard to yield deformation. The second phase evaluates the earthquake response of three buildings in Anchorage, Alaska, during the 1964 shock, with a calculation of probable types and locations of failure, and a correlation with what actually occurred. The third phase examines the design criteria in existing building codes, and makes recommendations for modification of minimum standards for enabling buildings to withstand earthquake forces without serious damage and collapse. Among the topics discussed are yield strength of girders and columns, damping, duration and vibration, stiffness, static loads, and nonlinear dynamics.

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Cables

INVESTIGATION OF WIRE ROPE SERVICE REQUIREMENTS AND DESIGN PARAMETERS

Battelle Memorial Institute. M. Dodson, W. H. Veazie, R. H. Fries, P. T. Gibson, and H. A. Cress. August 1969. 165 pages.

AD–709 471

A report is made on the use of wire rope in marine environments, including the types of wire rope being used, problems and hazards associated with their use, and design specifications. Conclusions and recommendations are given on such considerations as maintenance, interchangeability, quality control, inventory management, and procurement. Field investigations are reported on applications aboard ships, rigging lofts, and carpenter stoppers. Statistical and graphic data are included for towing hawsers, safety nets, wire rope sockets, and fittings. Costs and reliability are also discussed. A wire rope status form contains descriptive information on wire ropes in current use.

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A SURVEY OF PUBLICATIONS ON MECHANICAL WIRE ROPE AND WIRE ROPE SYSTEMS

Catholic University of America. H. Vanderveldt Hendrikus, and Ron De Young. August 1970. 130 pages.

AD–710 806

A report is made on the mechanical properties of composite wire rope, as influenced by behavior of the single wire, the single strand, and their combination into complex structures. Better understanding is sought regarding the parameters of response, fatigue characteristics, corrosion resistance, shock and impact behavior, and protective treatments. The document discusses the incidence of failure as the result of such factors as manufacturing methods, fatigue, corrosion, shock, erosion, and wear, strength of materials, improper handling and lubrication, and electrical properties. A review is given of the literature on the three most important causes of failure. Consideration is directed to problems encountered, including physical hazards to personnel, loss of time and material, and costs. Thermal properties are noted, along with formulas for determining stresses.

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SKYLINE TENSION AND DEFLECTION HANDBOOK

Pacific Northwest Forest and Range Experiment Station. Hilton H. Lysons and Charles N. Mann. 1967. 46 pages.

PB–190 659

SKYLINE TENSION AND DEFLECTION HANDBOOK SUPPLEMENT

Pacific Northwest Forest and Range Experiment Station. Charles O. Campbell. 1970. 28 pages.

PB–190 660

The basic Handbook provides a detailed procedure for determining the capabilities of both single- and multi-line skyline cables, as used in skyline (high-line) logging. The procedure is divided into a graphical determination of the maximum allowable deflection and a mathematical determination of payload capability. The supplement to the Handbook presents a graphical solution for the calculation of payload capabilities.

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Civil Engineering

EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM-DRAIN OUTLETS

Army Engineer Waterways Experiment Station. Joseph P. Bohan. January 1970. 56 pages.

AD–702 247

The document is concerned with need for adequate means of predicting the amount of erosion which will occur downstream from a culvert or storm drain outlet, and of determining the size and extent of a riprap, or broken stone, blanketing which will be sufficient to prevent such erosion. Experiments are reported which were made to determine the characteristics of scour or erosion holes formed at various flow conditions, using hydraulic models of various culvert configurations and several sizes of crushed stone. A number of tailrace water discharge conditions were investigated, aimed at developing a blanket configuration which would prevent failure and soil erosion at a culvert or storm drain outfall. Recommendations are included in consideration of types of flow and types of soils, and mathematical models are formulated to describe desirable configurations.

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AGRICULTURAL FLOOD CONTROL BENEFITS AND LAND VALUES

Institute for Water Resources. Raymond J. Struyk. June 1970. 199 pages.

AD–727 703

Two relationships of the value of land to flooding are examined. These are: That flood risks affect land values significantly; and that hydrologic risks influencing the land market appear to be biased in the direction of frequent flooding, with underassessment of damages associated with infrequent major floods. The report is concerned with the need to develop a viable way to estimate the impacts of flooding on land values, recognizing that land values tend to understate the effects of flooding and that interest rates applicable to land values involve uncertainties in management skill, weather, insects and disease, and similar phenomena. A multiple regression analysis method is described which seems reliable. The monograph is intended to serve as a guide for data acquisition and use.

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PRECOMPRESSION FOR IMPROVING FOUNDATION SOILS

U.S. Army Engineer Waterways Experiment Station. S. J. Johnson. June 1969. 94 pages.

AD–731 111

Precompression involves compressing soil under an applied pressure prior to placing or completing a structural load. The rapidly increasing interest in precompression techniques is due to the large savings that often result and to the increasing scarcity of advantageously located land that is available and that offers good foundation conditions. Large areas of poor subsoils are found in or near many of the major cities of the world. These marcinal areas can be reclaimed at a small fraction of the cost of other alternatives, and precompression is often applicable for this purpose. Densification or improvement of soils through the use of precompression techniques is discussed in this document from the viewpoint of a practicing engineer seeking to improve foundation subsoils which, in their natural conditions, are unsuitable for supporting a structure. The procedures discussed are based on current application of appropriate practical and theoretical knowledge. A bibliography of the basic literature on the subject is included.

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FLEXIBLE PAVEMENT FOR TOMORROW'S MAJOR AIRPORTS

Army Engineer Waterways Experiment Station. D. N. Brown, G. M. Hammitt II, and D. M. Ladd. August 1969. 31 pages.

AD–731 113

The report deals with the requirements for airport pavements, limiting its coverage to flexible pavement structures capable of use by larger jet aircraft which appear to be representative of those which will operate on the major commercial airports of the near future. Of especial concern are thickness and compaction requirements. A discussion is presented of factors which must be considered in flexible pavement design, including load distribution, load repetitions, cover thickness, and strength. Statistical data are tabulated for several aircraft according to gross load, area of tire contact, and number, configuration and spacing of wheels. Pavement design curves are given for variations in load and thickness; and required compaction is tabulated against gross aircraft load for ten different aircraft types. Also tabulated are data showing the effect of representative aircraft of tomorrow on a typical pavement existing at today's major commercial airports, including thickness requirements for 5000 coverages, allowable traffic coverages, and reduction in pavement service life, all as a function of gross load.

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RESEARCH IN GROUND SUPPORT AND ITS EVALUATION FOR COORDINATION WITH SYSTEM ANALYSIS IN RAPID EXCAVATION

Jacobs Associates. George E. Wickham and Henry R. Tiedemann. September 1971. 29 pages.

AD–732 029

A major consideration in tunnel engineering is the ability of rock to support itself. As the need for additional support increases, the importance of geological evaluation increases correspondingly. The document reports on a program dealing with methods of geological prediction of the ground support requirements for tunnels, based on the investigation of 32 tunnel projects on record. A method of evaluating a rock mass structurally is presented which is based on the interrelation of seven geologic factors, leading to a numerical rock structure rating of 0 to 100, where zero indicates no support required. Information analyzed includes surface and historical geology, site inspection, topography maps, geologic profiles, borings, seismic data, and structure correlations for specific tunnels. Case history study data includes the size of excavation sections, total length, number of study sections, and method of excavation.

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EXAMINATION OF HIGH PRESSURE WATER JETS FOR USE IN ROCK TUNNEL EXCAVATION

Oak Ridge National Laboratory. W. C. McClain and G. A. Cristy. January 1970. 53 pages.

ORNL–HUD–1

In any rock tunneling system or procedure, the first problem is to break the material at the head of the tunnel away from the solid matrix and reduce it to a size suitable for removal. In conventional tunneling, this is accomplished by explosive blasting. The recently developed continuous tunneling machines represent an improvement over the inherently cyclic conventional systems, but the rate at which they can break rock is limited by the enormous thrust which must be developed to push their roller bits against the rock and by the need to replace the bits frequently. This report describes a series of experiments conducted to evaluate a promising new method of rock breakage—the use of small diameter jets of water at high pressures—for application in tunneling machines. The results indicate that the method is feasible. A tunneling machine based on this method could offer several important advantages in addition to the possibility of increased rate of advance compared with existing methods. The data presented in the report provide the basis for further research leading to the development of a full size tunneling machine.

SYSTEM REQUIREMENTS FOR UNDERGROUND UTILITY INSTALLATION

Oak Ridge National Laboratory. W. J. Boegly, Jr., W. L. Griffith, and W. C. Ulrich. February 1971. 94 pages.

ORNL–HUD–19

The upgrading and extension of urban public utility systems is a constant and necessary process, and where utility networks are buried under the city streets the process is disruptive and expensive. There is consequently a search for new technology in this field, one possibility being the substitution of tunneling in place of trenching for the installation of underground utilities. The document discusses current utility installation practices for water, sewers, natural gas, electric power, telephone lines, television, central heating, and central cooling. Current excavation practices are described. Requirements for utilities installation are outlined, with a summary of alternatives. Estimates are presented for future systems, using both conventional and advanced technology, and a benefit cost analysis is given.

A SYSTEMS STUDY OF SOFT GROUND TUNNELING

Fenix and Scisson, Incorporated. Arthur D. Little, Incorporated. May 1970. 439 pages.

PB–194 769

Since the present cost and time required for tunnel construction pose major barriers to the construction of economically feasible subsurface transportation and utilities systems, there is a great deal of interest in the development of new or improved methods and equipment for less costly and more rapid excavation and tunnel construction. This report deals with the type of tunneling called Soft Ground Tunneling (SGT), where the material or soil is not competent and the opening is in immediate danger of collapse. It is one of the first organized, systematic investigations of new ideas and radical concepts for SGT. An effort is made to investigate the potential feasibility and cost-benefits of the largest number of ideas and concepts. It involves looking at SGT as a total system—from preplanning and topside support to actual excavation, muck removal, and line installation; it also includes identifying specific subsystem activities (for example, materials handling) and studying interactions among the different subsystems. As a result, five SGT systems are identified as having the greatest potential for reducing tunneling costs and increasing system advance rates.

COMPUTER ORIENTED STABILITY ANALYSIS OF RESERVOIR SLOPES

Perdue University. Water Resources Research Center. R. K. Carter, C. W. Lovell, Jr., and M. E. Harr. January 1971. 129 pages.

PB–198 432

During the planning and development of a reservoir, a condition generally not assessed is the stability of the slopes bounding the reservoir pool. Accordingly, the consequences of reservoir filling and fluctuations on developments on, or adjacent to, these slopes are unknown. Although failures of reservoir slopes are not very common, the results can be catastrophic in terms of both personal property and loss of life. A systematic technique has now been developed for determining the potential instability of reservoir slopes. The technique, which employs a set of computer programs written in elementary FORTRAN IV language, is proficient in accomodating a complex ground surface and subsurface profile of spatial variations in material properties, a steady state flow domain, and both uniform and concentrated ground surface loadings. Efficient search patterns are provided to assist the engineer in locating the critical shearing surface. Program listings and documentation are included, and conversion of the programs to small computer systems is considered highly practical.

ECONOMICS OF WASTEWATER COLLECTION NETWORKS

Illinois University. Jarir S. Dajani, and Robert S. Gemmell. June 1971. 69 pages.

PB–202 418

The study addresses the question of understanding the nature of the cost functions of a service network with a public works content. The provision of wastewater collection services is used to demonstrate how technological relationships and principles of micro-economics can be used to generate normative cost functions for such service networks. In doing so, the study explores both the demand for the service, as measured by parameters of urban development, and the supply of the service, as determined by the basic technology of providing it. The implications of the different methodologies and models presented in this study are presented. The concepts of otimizing the design of a technologically based urban service by rigorously incorporating cost as an input to the design process is stressed.

URBANIZATION AND SEDIMENTATION—A BIBLIOGRAPHY

Water Resources Scientific Information Center. October 1971. 120 pages.

PB–203 188

An an area becomes more urban, sedimentation load of surface water increases. This is due to a number of factors. One such cause is the increased construction and removal of ground cover. This exposes the topsoil to erosion by rain and wind. Another reason for sedimentation is from the declining number of unbuilt areas where rainwater can be absorbed. After an average rain, large volumes of flowing water are produced which easily erode any open land they contact. Presented is an annotated bibliography on this problem. It is comprised of 116 abstracts of current and earlier pertinent reports, journal articles and other publications on urbanization and sediment problems. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. The bibliography was produced by computer retrieval from the information base of Selected Water Resources Abstracts (SWRA), which had 31,244 abstracts at the time of the retrieval. The KWIC method of indexing is used in which each significant word in the title is filed in alphabetical place.

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EXPLORATION METHODS

Kentucky University. Vincent P. Drnevich. August 1971. 45 pages.

PB–203 670

Intelligent design of civil engineering facilities usually requires data on subsurface characteristics of the soil, such as load carrying capacity and deformation properties or permeability. A report is made on two newly developed methods for determining the loading characteristics of soils. The Dutch cone penetration test involves a hardened steel cone which is hydraulically pushed into the soil at a standard rate by improved mechanisms and strain gage instrumentation. The seismic refraction survey, which has been adapted from bedrock investigation techniques, utilizes the characteristics of wave propagation through the soil. The document discusses rock surface location and profile investigation, with a description of cone penetrometers, drill rigs, geophones, and seismic timers used. Basic principles are reviewed and relationships between the modified techniques and standard testing are presented.

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Control Systems and Computers

DEVELOPMENT OF A CONTROLLER ELEMENT FOR COMPATIBLE OPERATOR CONTROL OF EARTHMOVING MACHINES

Systems Technology, Incorporated. D. E. Johnston, D. H. Weir, R. F. Ringland, and L. G. Hofmann. March 1970. 224 pages.

AD–703 899

The operation of earthmoving and terrain manipulation machines is a complex and demanding task even for an experienced operator under good conditions. Integration of manipulators and the enhancement of the operators sensation of the status of his machine and task provide a very promising route toward simplification and improved performance. A systems approach is demonstrated which integrates the human operator, controller, vehicle, and control task dynamics and operational considerations in the definition of three potential controller modifications, each offering substantial improvements over existing controllers. A prototype manipulator is defined which has the potential of improving dozing performance, reducing training time, and easing the operator workload. The prototype design configuration consists of a single-lever, two-axis electromechanical manipulator with an integrated force-feel system; an electronic amplifier and signal mixing unit; and two electrohydraulic transfer valves. This system is simple, relatively easy to mechanize, and forms the basic forward loop for future incorporation of acceleration feedback.

COMPUTER TECHNOLOGY IN DEVELOPING COUNTRIES

Agency for International Development. March 1971. 199 pages.

PB–203 327

It is recognized that growth in the use of computer technology in developing countries is certain. This document represents the proceedings of a symposium, held at American University, Washington, D. C., on 22-23 March 1971, which was devoted to the question of the extent to which the financial, manpower and facilities of these countries can be devoted to modern data processing equipment, and the steps that can be taken to ensure that this investment is effectively employed. Specific topics covered include: General aspects of computers and economic development; economic considerations in national decision making concerning the importation and use of computers; the most attractive computer applications in cost/benefit terms for countries at different levels of development; the capabilities of computers with reference to the needs of developing countries; practical problems of efficient installation, operation, and maintenance of computers using indigenous personnel; United Nations activities in computer technology and usage in developing countries; training and education in computing for developing countries.

ADAPTIVE CONTROL SURVEY

Metcut Research Associates, Incorporated. John F. Kahles. May 1971. 113 pages.

Y–1759

The report provides a comprehensive survey of the present status of adaptive control as it is applied to all types of machining processes. The survey is based on a review of about 550 documents, visits to 15 plants, and the results of an extensively circulated questionnaire. A bibliography of 439 references is included.

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Environmental Engineering

PACIFIC CONFERENCE ON URBAN GROWTH. THE NEW URBAN DEBATE

Agency for International Development. Milton Kaplan. 1968. 84 pages.

PB–188 853

Growth of urban crises in seventeen Asian countries has led to increasing search for ways of dealing with it. A conference was held in Hawaii in 1968 to discuss the problems of massive migration and over-rapid urban surge, and means of relieving abominable conditions in overcrowded cities along with how to obtain resources for such alleviation. After reviews of the problems came proposals for remedies and solutions. The report reprints the discussions under the heads of prior doctrines, emerging doubts, the functional approach, and recommendations. The conference underscored the lack of urban planners, and called for the establishment of training, study, and research centers on urban growth.

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HANDBOOK OF AIR POLLUTION

National Center for Air Pollution Control. James P. Sheehy, William C. Achinger, and Regina Simon. 1969. 231 pages.

PB–190 247

Individuals working in the air pollution field often need access to data concerning the characteristics and behavior of air, gases and particles, and the chemistry of atmospheric pollutants, and to data of a general nature such as mathematics and common conversion factors. At present, to have access to all this information, the individual needs a wide variety of reference books. The report was designed to consolidate the applicable portions of these numerous references into a single, easily accessible source. It contains conversion tables and mathematical summaries for the computation of time; temperature; lengths; areas; velocity; capacities, volumes, and flow rates; mass, pressure, and gaseous conversion factors. Other data include properties of particulates, properties of air, properties of potential pollutants, and medical information.

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THE ENGINEER AND THE ENVIRONMENT

University of Minnesota. R. W. Burwell, C. I. McGinnis, E. R. Allred, W. J. Ochs, B. W. Rounds, G. J. Kelnhofer, R. W. Comstock, and L. Weinberger. August 1971. 55 pages.

PB–202 853

The publication contains the papers presented at a seminar on the engineer and the environment, held at the University of Minnesota on 20 November 1970. The purpose of the seminar was to inform engineers of current environmental issues, with particular emphasis being placed on water resources problems. The planning for the conference was based on the premise that the engineering profession should be aware that environmental issues are of paramount concern to society and that the profession is responsible for giving full consideration to these issues in addition to fulfilling the traditional role of solving purely technical problems. The subjects of the papers are: An Ecological Approach to Natural Resource Problems; Drainage and the Environment; Environmental Aspects of Water Resources Planning and Development; Social Aspects of Ecology; The State Concern in Engineering Planning for Water Resources; and The Challenge of Environmental Concerns in the Future of Engineering.

ENVIRONMENTAL CONSIDERATIONS FOR CONSTRUCTION PROJECTS

Agency for International Development, Office of Science and Technology. July 1971. 36 pages.

PB–203 326

The quest of the developing nations of the world for higher standards of living often involves the deliberate modification of the natural environment to achieve economic objectives. However, construction projects sometimes result in concomitant losses of ecological or social/cultural values. It is thus highly desirable that all who are involved in a proposed project have as clear an understanding as possible of the potential environmental consequences of a development activity at an early stage of project planning. For this reason, the document provides a set of environmental considerations for each of 12 types of development project: Road construction, port and harbor development, airports, irrigation systems, dams, power plants, petroleum-petrochemical industry, mining activities, smelting plants, pulp and paper industry, fertilizer plants, and sewerage and sewage treatment projects. The considerations, when used in conjunction with the literature sources cited in the document, are useful indicators of the types of expertise and information required to address in detail the environmental aspects of various projects, as well as provide a framework for the development of procedures and guidelines for systematic review and consideration of environmental factors.

ENVIRONMENTAL PROBLEMS IN SELECTED DEVELOPING COUNTRIES (PRELIMINARY SURVEY)

Agency for International Development, Office of Science and Technology. July 1971. 17 pages.

PB–203 380–U

Man is becoming increasingly aware that his environment is limited. The air, water, and soil resources in many parts of the world have already become seriously degraded. However, the values attached to environmental quality vary significantly at different stages of a nation's economic development, and in different cultural settings. This report provides the results of a preliminary assessment of the environmental problems in 35 developing countries. General suggestions for positive actions for the protection of ecosystems and the abatement of pollution in these areas are included.

Highway Engineering

QUALITY ASSURANCE THROUGH PROCESS CONTROL AND ACCEPTANCE SAMPLING

Bureau of Public Roads. April 1967. 83 pages.

PB–190 671

Quality assurance for highways requires the proper answer to two questions: How does one order what is needed to perform the service required; and how does one know that one is getting what was ordered. This document summarizes the status of studies relating quality assurance, defines the significant aspects of the problem, and presents statistical definitions and concepts needed for application in specification writing. The first two of these topics should be of general interest to all transportation industry personnel, while the last topic is intended primarily for researchers, specification writers, and others more familiar with statistical concepts.

STUDY OF A PROPOSED PRECAST-PRESTRESSED COMPOSITE BRIDGE SYSTEM

Missouri University. John R. Salmons. May 1970. 60 pages.

PB–193 114

Development of highway systems brings into importance the allied domain of bridge construction, especially as related to efficiency of structures and economy in costs. Prefabricated and precast structures have exhibited these characteristics in the construction of buildings, but interest in such forms has lagged for bridges. The study aims to assist in overcoming this deficiency by demonstrating the advantages of precast concrete for bridges in a system which incorporates pre-tension prestressing, composite construction, and virtual elimination of the forming of the bridge superstructure. A composite box formation is proposed, for which structural performance is predicted, including composite behavior, load-displacement and load distribution, and failure modes. An evaluation of costs is made and design considerations are presented. Recommendations are also included.

FLOOD PROTECTION AT BRIDGE CROSSINGS

Colorado State University. D. B. Simons, and G. L. Lewis. 1971. 175 pages.

PB–204 083

Stabilization of channels in the vicinity of highway bridges requires familiarity with the relationships between the stability of protection forms and the hydraulic properties of the crossings. This design manual concerns raprap protected spill-through abutments, with particular attention given to the establishment of standards for erosion protection. An example for a prototype bridge crossing is included to clarify the suggested design procedures.

Hydraulic Engineering

GOVERNOR CHARACTERISTICS FOR LARGE HYDRAULIC TURBINES

Bureau of Reclamation. F. R. Schleif. February 1971. 27 pages.

PB–199 217

In considering appropriate parameters for large hydropower generating units, control characteristics to satisfy power system needs strongly influence economics of the design. To aid designers with a basis for the most economical combination of parameters, an analysis of control system requirements and their interrelation was undertaken. As a result, refinements of governing systems are detailed in the document which will benefit speed control, area load control, and the coordination of these two functions. The refined governing systems can accomplish the desired control with less confinement from the basic parameters of water starting time mechanical inertia that would be imposed by the heretofore conventional governing systems. The results of the investigation are considered applicable to hydrogenerating installations in general, and the expense of incorporating the refinements should be small.

HYDRAULIC JUMP TYPE STILLING BASINS FOR FROUDE NUMBER 2.5 TO 4.5

Illinois State Water Survey. Nani G. Bhowmik. 1971. 35 pages.

PB–200 641

Hydraulic jumps in the Froude number range 2.5 to 4.5 are encountered in canal structures, diversion or low-head spillways, and sometimes in culvert outlet works. Therefore, occasionally it is necessary to design a stilling basin to perform at such low Froude numbers. The report provides design criteria for this type of stilling basin.

Industrial Engineering

QUALITY ASSURANCE RELIABILITY HANDBOOK

Army Materiel Command. October 1968. 435 pages.

AD–702 936

The handbook on quality control is intended to serve as a guide for project and commodity managers as well as professional personnel in the planning, direction, and monitoring of reliability programs. Extensive coverage is given of life cycling, systems effectiveness, and reliability levels; planning, management, contracts, programs, and personnel training; technical requirements, mathematical models, and basic principles; demonstrations, testing, and evaluation; failure analysis, and concepts. Examples, applications, and solutions are included.

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FAILURE ANALYSIS. THEORY AND PRACTICE

Army Materials and Mechanics Research Center. Joseph I. Bluhm. May 1970. 103 pages.

AD–707 463

The problem of metal failure, especially fracture propagation, is receiving increasing attention with ever increasing use of higher strength structural materials, since such materials usually involve a trade-off of ductility, toughness, or both. As a result, test procedures are sought which can accurately predict fracture resistance as simply as possible. Two types of test structures are covered—the unnotched cylindrical tensile specimen and the notched slow bend specimen. Performance characteristics under stress are discussed for these forms, between the extremes of hydrostatic compression and hydrostatic tension, thereby presenting a wide variety of response conditions. The effects of temperature and stress levels are examined. Crack behavior is given special consideration. Test equipment is described and correlations between samples and prototypes are associated with the nature of fracture mode. Concepts leading to safeguards against failure are discussed.

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ANALYSIS OF RELIABILITY AND MAINTAINABILITY MODELS

New York University. Masafumi Sasaki. 1966. 49 pages.

AD–729 144

The report contains technical discussions of mathematical models formulated to evaluate systems reliability and maintainability, as presented in a 1966 technical conference at New York University. The treatment is mathematical, consisting principally of theorems and exponential equations applicable when a maintenance crew is available, the maintenance time is small enough to be disregarded, time to failure and repair are not mutually exclusive, the device retains its failure rate after maintenance, and the statistical distributions of failure and repair are indeed exponential. Two other availabilities involve equipment and mission: the probability that a stated percentage of equipment will be available for use in the subject time, and the probability that a stated percentage of missions in subject time will not suffer failure incapable of repair. The models incorporate considerations of cost, weight, volume, and similar constraints. Theorems are presented to represent rates of failure and maintenance action under time constraint, including switchover redundancy when standby equipment is available, and examples are given.

MEASUREMENT TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 23 pages.

N71–28402

A number of measurement methods and devices developed by or for NASA have potential applications outside of the aerospace industry. Data are given for pressure, temperature, linear, angular, and surface measurements. The document gives also the characteristics of fluids in the area of leakage and flow rates, and the systems used to determine such activities. A form for requesting additional technical information is included.

TECHNICAL PAPERS PRESENTED AT PRACTICAL INDUSTRIAL ENGINEERING WORKSHOPS

West Virginia University. R. D. Fowler and R. E. Ward. August 1971. 212 pages.

PB–202 117

Practical engineering workshops were held at West Virginia University in 1970 and 1971 as a means of providing industrial engineers with information and techniques through which to strengthen job performance. Areas covered were human factors, engineering economics, forecasting, and project management, with systems engineering providing background. Discussions reprinted here include those on information systems, decision making, mathematical modelling, design criteria, analog systems, statistical processes, cost analysis, return on investment, and industrial psychology. Much of the material appears in tabular and graphic form. Optimization and control are of especial interest.

Machinery and Tools

FOIL BEARING DESIGN MANUAL

Ampex Corporation. A. Eshel and L. Licht. September 1971. 83 pages.

AD–731 393

The concept of a foil bearing arises from the ability of a thin film of air or liquid to support a flexible web of paper, plastic or metal under tension in transport over a cylindrical roller, and the ability of a fluid film entrained between a journal and the surface of a stretched flexible foil to float a high speed rotor. Either system constitutes a foil bearing, consisting of a rigid surface and a thin flexible surface separated by a fluid film. A discussion is given of the advantages of these bearings as compared to conventional rigid surface bearings. A compendium of theoretical and experimental results, available at the present in the field, is presented. Design formulae are given, along with mathematical models and graphic analyses of performance and properties, with application to the engineering of rotating machinery.

ENGINEERING DESIGN HANDBOOK. HYDRAULIC FLUIDS.

Army Material Command. April 1971. 288 pages.

AD–884 519

The development of a high level of technology depends on the evolution of methods for the generation, distribution, and utilization of power. An increasing demand for power requires the continued development for power transmission, control, and utilization. Fluid power technology plays an important role in this task and promises to be even more important in the future. The objectives of this Handbook are: To collect diverse sources of information to conserve time, materials, and money in the successful design of new equipment; to provide guidance to personnel new to the field and to experienced engineers in other fields who require information about hydraulic fluids; to supply current fundamental information; and to place the reader in a position to use new information generated subsequent to the publication of this Handbook. The general topics included within the scope of the publication are: Principles of hydraulics; power transmission equipment; fluid properties, significance, and test methods; types of hydraulic fluids; additives; and storage and handling.

VALVE TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 20 pages.

N71–28282

A number of advances in valve technology developed by or for NASA have potential applications outside of the aerospace industry. The document discusses relief valves, cryogenic check valves, valves for extreme conditions, safety valves, and leakproof designs. Other subjects covered include energy absorption, pressure and temperature sealing, air conditioning, freeze drying and storage, and basic research and development in the area of calibration. The document also provides a form for requesting additional technical information.

FLUID TECHNOLOGY (SELECTED COMPONENTS, DEVICES, AND SYSTEMS): A COMPILATION

National Aeronautics and Space Administration. 1970. 19 pages.

N71–33142

A number of innovations in fluid components, devices, and systems developed by or for NASA have potential applications outside of the aerospace industry. The items discussed in the document may be of particular interest to the designers and manufacturers of hydraulic and pneumatic components, fluid filtration systems, and fluid calibration systems. The document includes several computer programs applicable to fluid technology, and also a form for requesting additional technical information.

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QUICK, LOW-COST DEVELOPMENT TOOLING AND PARTS FROM PHOTOPOLYMER

Sandia Laboratories. T. A. Allen. March 1970. 31 pages.

SC–DR–70–59

Photopolymer materials, photosensitive plastics which can be optically formed by photographic methods to produce three-dimensional configurations, offer a quick and economical way to reproduce precisely, in depth, a planar image. The use of photopolymers may in many cases eliminate the expense of layout and machining for small castings, training aids, fluidic elements, milled jigs, assembly fixtures, metal pantograph masters, drilling or routing templates, complex molds, and other tooling. And intricate parts can be made of photopolymers: cams, mechanical and electrical programming discs—or combinations of both, encoders, gears, gaskets, racks, oven programming masters, etc. The report describes the characteristics of an alkali-soluble, partially acrylated cellulose acetate based photopolymer mounted on a heavy aluminum backing plate. Its characteristics, processing requirements, and some of its applications in development-shop support of engineering activities are presented.

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AIR-BEARING STEADY REST FOR PRODUCTION MACHINE TOOLS

Union Carbide Corporation. P. J. Steger, and M. L. Shell. March 1970. 18 pages.

Y–SC–4

A type of conventional steady rest used in machining applications usually consists of rollers supported on ball bearings which are lubricated with grease or oil and cooled with a cutting fluid. While this arrangement is generally satisfactory for low-speed machining operations, problems arise as the surface speed of the workpiece increases due to significant heat generation, roller vibration, and chip fouling. Frequently, the lubrication system fails, resulting in bearing deterioration which damages the steady rest and/or machining fixture. The design and fabrication of two types of air-bearing steady rests was undertaken to alleviate these problems. These steady rests eliminated chip fouling and also improved the thermal stability and reduced the vibration resulting from high surface speeds. This document describes these improved steady rests.

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FREEZE DRYING

Defense Documentation Center. February 1970. 133 pages.

AD–702 700

Freeze drying is drying in a frozen state under high vacuum so that ice or other frozen solvent sublimes rapidly and a porous solid remains. The 106 references in this annotated and indexed bibliography contain information on freeze drying used in chemical and biological research and in food preservation. The research reports listed cover the period 1953–1969 and were funded by the United States Government. The reports are available from NTIS.

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QUENCHING (COOLING)

Defense Documentation Center. April 1970. 156 pages.

AD–704 400

The 118 references in this annotated and indexed bibliography deal with various techniques of quenching (suddenly cooling) metals and alloys to optimize their properties. The research reports listed cover the period 1960–1969 and were funded by the United States Government. The reports are available from NTIS.

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MATERIAL FORMING AND MATERIAL REMOVAL

Defense Documentation Center. June 1970. 179 pages.

AD–707 800

The bibliography is comprised of summaries of U.S. Government funded reports dealing with the methods of forming and removing materials in machining stainless steel and alloys of nickel, cobalt, titanium, and aluminum. Among the subjects treated are extrusion, ceramic materials, powder metals, surface properties and preparation, improvement of castings by vibration and arc processes, temperature control, explosive forming, deposition, electrolytic machining, silicon fibers, lubrication, laser applications, impact forming by electrohydraulic shock, cavitation and oxidation concepts, defects, and alloy treatment. Applications are discussed in several manufacturing and engineering fields. The documents listed in the bibliography are available from NTIS.

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PRINCIPLES OF INCREMENTAL FORGING

Illinois University. R. H. Abramowitz and J. A. Schey. July 1970. 64 pages.

AD–711 303

Conventional forging techniques produce a finished forging by shaping the workpiece in a succession of dies. When parts are of materials difficult to form, complex shapes may demand three or more blocking steps, requiring a multiple die set. The cost of this set is particularly high when only a relatively few forgings of a shape are needed; consequently, new techniques are being investigated. Incremental or successive step forging in a single device is one of these, but experimental work using hot materials presents difficulties, and a search for reliable room temperature analogs has been conducted. The document describes an investigation using plasticine, lead, and commercial purity aluminum as analog materials, and discusses the procedures using aluminum as the most productive. Forging operations are essentially a series in which the deforming tool makes contact with the workpiece only at selected points in each step to produce the desired three dimensional material flow. A thin web, tall rib configuration and shapes with cross ribs and side ribs were chosen for the experiments. Results indicate that incremental forging is a feasible process. Further development work is described in AD–729 012 (See below).

WEATHERPROOFING (INDUSTRIAL PROCESSING SERIES)

Defense Documentation Center. March 1971. 174 pages.

AD–722 801

The bibliography is comprised of summaries of U.S. Government research reports on weatherproofing covering the period December 1959 to February 1970. It covers methodology such as corrosion inhibition, protection from rain erosion and moisture, protection for storage and packaging, and vacuum firing of wire; some of the materials treated are organic binders for concrete, rain repellants, oil base stains for wood siding, and heat resistant paints for metals. Mathematical models and test methods are described. Applications include wood laminates, watertight coaxial cables, copper treated wooden hulls, plastic diaphragm coatings, coconut shell fillers, sunproofing waxes, and sprayable coatings. Specific equipment includes resistors, electrodes, batteries, bearings, and electric cables. The reports listed are available from NTIS.

PRINCIPLES OF INCREMENTAL FORGING: PHASE 2

Illinois University. R. H. Abramowitz and J. A. Schey. July 1971.

AD–729 012

In conventional forging operations, a finished shape is produced by forming the workpiece in a succession of dies. Many forged parts utilized in present day engineering are of materials that are difficult to form, and complex shapes often demand three or more blocking steps for an adequate filling of the finishing die cavity. Investigation of alternative techniques has led to the process of incremental forging, a technique in which non-axially symmetric parts with cross sections changing along their length are formed with tools that deform only a small portion of the workpiece at any one time. The report describes the special tooling necessary for this procedure. The final section deals with deformation problems when indenting with a rectangular anvil. Simulation of metals by means of plasticine, lead, and commercial purity aluminum was used successfully to facilitate experimentation at room temperatures. The document discusses the equipment, process development, and process parameters, including a 200-ton press and sub press, a forging manipulator, punch development, bite, friction, and lubrication. Details are given on sequencing and control.

INVESTMENT CASTING TO ENHANCE PRODUCIBILITY —A CASE STUDY

Bendix Corporation. W. E. Cromwell, and J. R. Larson. March 1971. 47 pages.

BDX–613–291

Effectively applying the ancient art of investment casting to production can open the door to improved product integrity and potential cost savings. This report describes a case in fact, where the investment casting process was successfully applied as a production method, replacing a formed sheet metal welded assembly. The casting approach not only sharply improved the probability of insuring conformance with required design limitations, but also resulted in substantial program cost savings. When the geometry of a required metal product indicates potential fabrication problems or excessive machining cost, the investment casting approach may be the means to a successful product.

FINE-EDGE BLANKING AND PIERCING

Bendix Corporation. H. J. Seese. June 1971. 24 pages.

BDX–613–366

Fine-edge blanking is a relatively new non-chip-forming production process which produces a finished metal blank with minimum secondary finishing or machining operations required for part completion. The process also permits the manufacture of complex, tightly toleranced small parts that formerly could only be fabricated by conventional machining or a blank and shave process. In replacing these processes, lower production and/or tooling costs are possible and improved part-to-part uniformity is realized. This report provides the results of an investigation of the capabilities and limitations of the process. It is shown that fine-edge blanking gives the designer of small parts for production an added dimension of flexibility.

MATERIALS HANDLING: A COMPILATION

National Aeronautics and Space Administration. 1970. 16 pages.

N71–30864

A number of materials handling operations and devices developed by or for NASA have potential applications outside of the aerospace industry. The document presents brief summaries on lifting, moving, and handling operations. Devices to facilitate lifting and transporting equipment under difficult conditions, and materials handling aids are described. A form for requesting additional technical information is included.

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ASSEMBLY TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 17 pages.

N71–31394

A number of innovations in assembly technology developed by or for NASA have potential applications outside of the aerospace industry. The document discusses tools, materials, techniques, and procedures which were developed to accomplish assembly tasks more efficiently and economically. A form for requesting additional technical information is included.

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METHODS FOR STUDYING, IMPROVING, AND OPTIMIZING ELECTRIC-FURNACE SMELTING PROCESSES

Bureau of Mines. Victor R. Spironello. 1970. 32 pages.

PB–198 248

Electric smelting technology includes processes which differ in detail in ways both obvious and obscure, so that an empirical view may be unreliable or misleading. When a change is required in an operation, trouble may ensue because of interaction between unrecognized variables; consequently statistical methods are being sought in the multivariable process to provide better control. The report describes three factorial designs aimed in this direction: a two-level design with estimates of variance, calculation of effects, and analysis representation; a fractional factorial design with like treatment; and a response-surface methodology with calculation of effects and paths of steepest ascent, plus examination of regions of interest. Matrix methods are used extensively. The document discusses the three optimization methods as usable with a minimum of trial and expense, and suggests extension to other fields.

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PROGRESS THROUGH MODERN PROCESSES AND TOOLS

Agency for International Development. George D. Thomas. March 1970. 332 pages.

PB–205 287

Basic materials are presented which are intended to help acquaint production planners and key production workers with the proper use of modern production techniques and the proper design and manufacture of standard production tools. Experience has shown that these standard techniques and tools will aid in the improvement of production efficiency, reduction of costs, improvement of quality, and making of component parts interchangeable. The specific topics covered include: Organizing for the specific control of quality and production; Cost reduction; Drafting room practice and tool engineering data; Steel specifications—Heat-treatment and uses; Jigs and fixtures; Standard clamps; Standard bushings; Carbide cutting tools; Steel stamping dies; Die casting instructions; Compression and transfer molding equipment (plastic dies); Foundary equipment and processes.

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Mapping and Surveying

MANUAL OF GEODETIC TRIANGULATION

Coast and Geodetic Survey. F. R. Gossett. 1971. 363 pages.

COM–71–50047

Triangulation is a method of surveying in which points on the ground form the vertices of triangles in chains or networks. When the figure and size of the earth are taken into account, the operation is called geodetic triangulation. This form requires precise equipment, superior observational techniques, capable personnel, and computation facilities. The document is concerned with the principal phases of the system, including reconnaissance, triangulation order specifications, project estimates, personnel procurement, organization, theodolites and other instruments, and supporting equipment such as towers, vehicles, and handling equipment. Operational features covered are signal building, observing methodology, lightkeeper procedures, and computational technology involving field editing, triangles, mathematical methods, and machine operations. Detailed treatment is given to base measurement procedures including precautions against errors. Azimuths and special surveys are discussed. Lists of miscellaneous pertinent data are appended.

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AERIAL CAMERAS, CAMERA CALIBRATION, AND AERIAL PHOTOGRAPHY

Geological Survey. R. Welch. May 1971. 82 pages.

PB–202 009

The document discusses aerial cameras under two major categories: Reconnaissance, including panoramic and strip instruments; and mapping, requiring special shutter, lens, and film features for narrow-angle, wide-angle, or super-wide-angle use. The photogrammetric mapping camera is analyzed for mount, body, lens cone, magazine, viewfinder, shutter, and lens characteristics. Guidelines are presented for selecting the proper aerial camera for a specific task. Camera calibration is explained in relation to the geometric and imaging properties of the camera system. A number of photographic parameters and natural elements, in addition to the camera itself, which affect the recording of photographic detail are decribed.

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WAVE ABSORBERS IN HARBORS

National Engineering Science Company. Bernard LeMehaute. June 1965. 138 pages.

AD–704 721

A recently growing area of concern is the absorption of wave energy in harbors, particularly as applied to wind waves or long waves which penetrate harbor basins through entrances or existing breakwaters, plus the development of resonances in such harbors. The report presents an analysis of wave absorber design, giving especial attention to rubble mound structures. A discussion is made of advantages and problems connected with various kinds of wave absorbers and wave resonators, including wave traps constructed of steep slope rock fill mounds, gentle sloped beaches, quays formed of vertical or horizontal platforms surmounting a rock fill, and previous works such as dense vertical piles. The design of an efficient wave absorbing harbor is considered as the analog of a radio resonator, consisting of such configurations as a truncated beach, a set of basins, or a series of vertical walls. The slope bed rockfill absorber is treated in detail, including the bottom slope for wave breaking, bottom roughness, and permeability. Scale model tests are described and discussed.

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CONTROLLABLE PITCH PROPELLERS

Naval Ship Systems Command. Gerald M. Boatwright, and John Strandell. March 1967. 52 pages.

AD–707 357

For most applications the controllable pitch marine propeller meets the need for a highly efficient and reliable means of providing a reversal of propeller thrust with the unidirectional gas turbine. The report presents a brief history of the use of controllable pitch propellers, with particular emphasis on the hydraulic actuated type. Comparisons are made of types available and how their variations affect overall ship design and performance. The design details of a controllable pitch propeller suitable for 40,000 SHP are presented. The report concentrates on only those designs that have represented a major step forward in achieving a high powered controllable pitch propeller capability.

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DESIGN OF NOZZLE PROPELLERS

Accurate Products Company. Peter G. Buehning. April 1967. 117 pages.

AD–727 580

Recent years have seen a great increase in interest in nozzle propellers (also called ducted propellers or Kort nozzles) for both aerial and marine applications. A nozzle propeller is basically a propulsion system involving a propeller inside a nozzle, which is designed to either accelerate or decelerate the flow at the propeller as compared with the ordinary propeller. The accelerating type will either produce more thrust with a given size propeller, or require a smaller propeller to produce the same thrust. This type also provides a relatively low noise level and better control of flow conditions. The decelerating type of nozzle propeller is applied in cases where the advantages gained from the lower flow velocity in the propeller plane are more important than the decrease in efficiency that will occur. The document provides curves for optimum diameter-rpm combinations applicable to the design of nozzle propellers. In addition, it gives a detailed design procedure for nozzle propellers with guide vanes.

CONCEPTUAL STUDIES AND PRELIMINARY DESIGN OF 180 TON CAPACITY CARGO TRANSPORTER BARGE

Hydronautics Inc. J. J. Slager, S. N. Gyves, H. W. Lain, and G. M. Poquette. August 1971. 251 pages.

AD–729 382

Work was undertaken to produce a preliminary design of a 180 ton cargo transporter barge capable of operation in unimproved harbors and having the following specific performance requirements: Improved hull resistance characteristic over those normally associated with this type of ship: a high degree of maneuverability; minimum gross weight with normal payload; simplicity of design (fewest number of parts, standardized parts, components with a high inherent reliability, etc.). The results of the design effort, which meet the above objectives, are reported in the document. A description of the major barge subsystems, a summary of all significant design analyses performed, and a set of reduced-scale standard preliminary design drawings are all included.

SELECTED BIBLIOGRAPHY ON THE ENGINEERING CHARACTERISTICS OF COASTAL INLETS

University of California, Hydraulic Engineering Laboratory. Pedro F. Castaner. August 1971. 29 pages.

AD–730 933

The document provides a survey of the literature and a 226 item bibliography dealing with the engineering characteristics of coastal inlets. Because the literature on this subject is widely scattered and difficult to locate, it is intended that this work will be of value as a time saving device for those seeking both specific information and a general background on the coastal inlet problem. The topics included deal mainly with the physical peculiarities of coastal inlets, such as the effects of waves, tides, flows, littoral drift, and sediments.

SELF REGULATING MARINE STEAM GENERATOR

Combustion Engineering, Inc. September 1970. 222 pages.

COM–71–00036

The self-regulating marine steam generator is one of a series of concepts being developed under sponsorship of the U.S. Maritime Administration in an effort to improve marine power plant simplification, maintainability, and reliability, as well as to reduce training time and initial cost. The report presents design and performance characteristics of the generator. The design utilizes a series turbine—forced draft fan—fuel pump concept of self regulation. Performance tests indicate that the series turbine principle is sound and yields satisfactory system stability and response.

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A UNIQUE ACOUSTIC TRACKING TECHNIQUE APPLICABLE TO DRAGLINE DREDGE SAMPLING AT SEA

Marine Minerals Technology Center. B. B. Barnes. September 1971. 36 pages.

COM–71–01013

Large-scale sampling of sediments on the surface of the sea floor, particularly for the purpose of minerals exploration, has given rise to a variety of methodologies and experimental tools, most of which have proved infeasible or ineffective for operations on all types of ocean bottom. A new technique for sampling surficial sea-floor sediments is described, using a dragline dredge in conjunction with a recording fathometer utilizing high-frequency acoustic signals and a radio tracking system to locate dredging positions. The report reviews the various types of sampling devices which have been produced, such as bucket-type dredges, grab and dart-type corers, and diamond drills, and proceeds to a discussion of new dragline dredge sampler. Here a body dragged on the bottom with a bent mouth engulfs and scrapes the bottom efficiently, while a safety retrieving line prevents loss in case of forward bridle rupture. Surface vessels and hoisting equipment are described, in addition to details of the dredge structure and instrumentation.

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WATERBORNE FEEDER SUBSYSTEMS FOR UNITIZED CARGO TRANSPORTATION, VOLUME 1

Arthur D. Little, Incorporated. March 1970. 88 pages.

PB–191 478

WATERBORNE FEEDER SUBSYSTEMS FOR UNITIZED CARGO TRANSPORTATION, VOLUME 2. APPENDICES

Arthur D. Little, Incorporated. December 1969. 213 pages.

PB–191 479

The planned development of large unitized container ships to serve only a few major ports has created interest in a waterborne feeder system from smaller ports to these major ones. A feasibility study was undertaken to assess possible demand for such a system and to select vehicle specifications which would appear to be appropriate in establishing it. Volume 1 describes the work and conclusions in narrative form, beginning with a discussion of the market environment and general cost considerations, proceeding to a selection of ship parameters and a cost analysis, and concluding with recommendations and conjectures. Of particular interest is the benefit to the world community. Volume 2 deals with the details of data handling in regard to mode-route allocations, origin-destination models, environmental factors, cost categories and analysis, trade estimates, and ship planning.

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TRANSOCEAN TUG-BARGE SYSTEMS. A CONCEPTUAL STUDY. VOLUME I. THE EXECUTIVE SUMMARY

Matson Research Corporation. Ernest Koenigsberg and Douglass S. Lathrop. July 1970. 28 pages.

PB–194 535

TRANSOCEAN TUG-BARGE SYSTEMS. A CONCEPTUAL STUDY. VOLUME II. THE ANALYSIS

Matson Research Corporation. Ernest Koenigsberg and Douglass S. Lathrop. July 1970. 113 pages.

PR–194 536

TRANSOCEAN TUG-BARGE SYSTEMS. A CONCEPTUAL STUDY. VOLUME III. APPENDICES

Matson Research Corporation. Ernest Koenigsberg and Douglass S. Lathrop. July 1970. 213 pages.

PB–194 537

Ocean barging, a comparatively new mode of large scale ocean transportation, originated in the United States and western Canada, and has reached its highest state of development there. Interest in this mode of transportation is growing more rapidly than interest in maritime transportation in general. This study explores the general advantages of transocean tugs and barges in direct competition with conventional self-propelled ships. It also explores the technological and institutional problems that have to be solved before the inherent advantages of tug-barge systems can be realized. The results of the study can be used by regulatory and development organizations for the purpose of formulating policies toward transocean tug-barge operations and in defining research and development programs. Operators of transocean transportation systems can use the results in determining the potential of tug-barge systems in their specific services and in solving the problems that must be faced before tug-barge systems can be installed in those services. Volume I of this series of reports summarizes the detailed materials provided in Volumes II and III.

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SLOPE STABILITY ANALYSIS BY THE FINITE ELEMENT STRESS ANALYSIS AND LIMITING EQUILIBRIUM METHOD

Bureau of Mines. Fun-Den Wang and Meng-Cherng Sun. January 1970. 20 pages.

PB–190 012

In open-pit mining, pit slope design is of primary concern because the economics and safety of the operation depend on the slope angle and stability of the excavation. In this report, a new method of slope stability analysis by the finite element approach is presented. This method of analysis is much more versatile than the conventional method of slices since both gravity and loading are included and no judgment is required on the part of the user to choose the side-force function. It is also a much more nearly exact solution than any method of slices because elastic stress analysis by the finite element method is used in the analysis.

A SYSTEMATIC ANALYSIS OF PIT SLOPE STRUCTURES BY THE STIFFNESS MATRIX METHOD

Bureau of Mines. Fun-Den Wang and Meng-Cherng Sun. February 1970. 41 pages.

PB–190 774

Open pit mining engineering involves a consideration of both rock mechanics and the shape of the pit. For the same slope angle, V-shape slopes have lower stress concentrations; hence they are infered to be more stable than flat-bottom pit slopes. The stress of pit slopes with slope angles ranging from 30 to 90 degrees of both the flat bottom and the V-shape pit slopes are given in this report. This, together with an equation of similitude which is presented, should enable one to calculate the stresses in any given pit slope of similar geometry with different dimensions and material properties. Quantitative values are provided which are useful in making judgments in the design of pit slope structures.

PRELIMINARY ENGINEERING STUDIES TO CHARACTERIZE THE MARINE MINING ENVIRONMENT

Bureau of Mines. Ernest L. Corp. May 1970. 39 pages.

PB–191 947

The oceans have potential as a great source of minerals, but any technology which seeks to benefit thereby must consider the environmental effect as well. The document discusses the development of methodology which is compatible to both fields, considering the natural marine environment to include the basic categories of air-sea interface, water zone, seafloor, and subbottom. The major emphasis is being placed on studying the subbottom material in order to assess its influence on the design of mining subsystems and the factors of penetration, excavation, transportation, and disposal. The effects of engineering properties on penetrability, core recovery, and sample recovery are discussed.

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PREDICTION OF COAL GRINDABILITY FROM EXPLORATION DATA

Bureau of Mines. Manuel Gomez, and Kathleen Hazen. August 1970. 38 pages.

PB–194 941

The grindability of coal is reported as usefully related to the physicochemical analysis of coal for industrial purposes, the development of optimum mining techniques, and the improvement of coke production processes. The document refers to the Hardgrove grindability test as one of the techniques for measuring the hardness, strength, and fracture properties of coal. A mathematical prediction model as constructed for this test is described, using data from 735 coal samples which included heating value and sulfur content. The results are intended to show that the mechanical properties of coal may be forecast through the testing and use of drill cores obtained before mining.

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A COMPREHENSIVE STATE-OF-THE-ART EVALUATION FOR ALL TYPES OF DUST COLLECTION EQUIPMENT THAT MAY BE APPLICABLE IN UNDERGROUND COAL MINES

Garrett Research and Development Company. Seymour Calvert and L. Karl Legatski. December 1970. 112 pages.

PB–197 739

Dust control in underground coal mines is essential to reduce explosion hazards and to prevent the exposure of workmen to harmful concentrations of airborne dust. With more prevalent use of continuous mining machines which generate large amounts of respirable dust, the problem becomes acute. The report discusses the various methodologies employed in controlling dust created by mining machines: treating coal before mining to prevent dust generation, control of fragmentation, dust suppression, collection of dust after generation, and increasing mine ventilation. An experimental investigation is described covering tests on multiclone equipment, scrubbers, air tumblers, and sprays. Costs and efficiency considerations are noted, and indications are given of efficiency to be expected.

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SUMMARY OF MINING AND PETROLEUM LAWS OF THE WORLD 1. WESTERN HEMISPHERE

Bureau of Mines. Northcutt Ely. 1970. 164 pages.

PB–198 256

This handbook provides a summary of legislation pertaining to minerals (including petroleum) in each of 30 countries in the Caribbean Islands, Central America, North America, and South America. Primary attention is given to requirements that must be met in each country for acquisition of rights to permit development mineral resources. Coverage includes: Identification of the controlling laws or statutes governing minerals acquisition and reference to the administrative authority; analysis of the laws governing mines and quarries and their products; analysis of laws applicable to natural gas, petroleum, and related minerals.

ROCK BURST RESEARCH AT THE GALENA MINE, WALLACE, IDAHO

Bureau of Mines, Denver Mining Research Center. Wilson Blake. August 1971. 25 pages.

PB–203 893

A minewide, automatic rock-burst monitoring system has been developed and field tested. Use of this system should allow rock-burst-prone mine structures to be detected, recognized, and evaluated on a routine basis by mine personnel. In related research, it was found possible to successfully destress a burst-prone stope pillar by blasting a single line of long holes in the footwall of the vein. As a result of destressing, the pillar is fractured and softened; hence it yields, releasing a large amount of elastic strain nonviolently.

LABORATORY EVALUATION OF SOME FACTORS IN CYANIDING GOLD PLACERS

Bureau of Mines. L. Nichols, H. B. Salisbury, and B. K. Shibler. 1971. 12 pages.

PB–203 668

Low-grade, placer gold deposits covered by an excessive thickness of barren gravel for economic, conventional dredging conceivably might be processed by inplace cyanide leaching. The characteristics of placers that might be suitable for inplace cyanidation include permeable gold-bearing strata, gold concentration near impermeable bedrock, and areas for leaching which are controllable by natural or artificial barriers. In such deposits, the gold may be extracted and recovered by injection and retrieval of solutions through wells for deep deposits or trenches for shallow deposits without excavating the entire deposit. Laboratory-scale research was conducted to define some of the major factors that might influence the dissolution of gold from placer deposits. The investigated factors include the effects of gold particle size and physical distribution in the deposit, cyanide solution flow rate, and cyanide strength. Other factors that influence solution flow rates and thus indirectly affect the gold dissolution rate also were studied. These variables include bed slope, hydraulic solution head, sand size, capillary action, and nature of the fluid flow. The possible influence of some mineral and organic cyanicides that might be found in placers is discussed.

Nondestructive Testing

NONDESTRUCTIVE EVALUATION OF METAL FATIGUE

Southwest Research Institute. F. N. Kusenberger, J. Lankford, Jr., P. H. Francis, and J. R. Barton. March 1970. 74 pages.

AD–705 653

Investigation of metal fatigue has usually been conducted under the considerations of solid state theory as expressed in single crystal or high-purity materials, with the result that an extrapolation of data to cover a polycrystalline or alloy metal is not reliable; nor can such findings lead to an understanding of crack propagation in a complex-structured metal. Accordingly, studies have been made recently in air and in vacuo to establish the influence of surface and near-surface structures on fatigue behavior. The report considers crack formation from the point of view of dislocation mechanisms, inclusions, and bonding characteristics; it proposes a treatment in which local regions suspected of crack initiation qualities can be studied by means of nondestructive testing; and extends an earlier analysis of microcrack growth to ascertain the extent of plastic yielding about a cavity. Defect site studies conducted by ultrasonics and magnetic fields are reported. Considerable data are presented in graphic form. Of particular interest are the electric current injection method and the surface wave pulse-echo method.

A SURVEY OF THE ULTRASONIC INSPECTION OF WELDS

Naval Ordnance Laboratory. Robert A. Youshaw. February 1967. 44 pages.

AD–718 811

The use of ultrasonics in nondestructive testing is receiving increased attention, since this methodology has the advantage of no harmful radiation, its instrumentation can be portable, its speed is superior to other methods, and defects can be found which are undetectable by other methods. A review of ultrasonic welding reliability is given which includes a study of the types of welds, materials used, and configuration tests, along with the standards of acceptance applied. In addition to a state-of-the-art review of the field, interviews with various company representatives on comparison with the pulse echo method are included. Topics covered include butt welds, thick plate materials, T-joint fusions, fillet welds choice of angle, surface roughness, coupling fluids, and recording systems for ultrasonic data.

A GUIDE FOR ULTRASONIC TESTING AND EVALUATION OF WELD FLAWS

Naval Ordnance Laboratory. R. A. Youshaw. August 1970. 22 pages.

AD–713 202

The document covers ultrasonic inspection of steel butt welds in the thickness range ¼ to 2 inches. Acceptability limits are those compatible with ship hull structures. The discussion includes such factors as personnel qualifications, calibration methodology and instrumentation, and discontinuities. Inspection is analyzed in which a shear wave is introduced into a plate at an angle, and test manipulation proceeds. A method is described for direction of a sound beam normal to the weld length and oscillation of a transducer through a small angle in scanning the entire weld.

APPLICATION OF PHOTOCHROMIC COATINGS FOR NONDESTRUCTIVE TESTING

Air Force Materials Laboratory. Sidney Allinikov. December 1970. 61 pages.

AD–720 239

A photochromic compound is a substance which reversibly changes its color on exposure to visible or ultraviolet light. The report discusses the use of such a compound formulated into a paint for use in the nondestructive testing of material defects. The technique is quite simple. The mixture is simply painted onto the material to be tested and irradiated with ultraviolet light. The colored paint surface is then heated by any suitable means, such as a hot air blower. Heat serves to bleach the paint to the original white color. Defects are disclosed because heat conductivity at the defect site is different from that of the rest of the area under inspection. The defect thus appears as a colored or white area dependent upon the nature of the defect and originating direction of the heat source. Some of the types of defects and kinds of structures are discussed. The method of preparation and materials used in the low cost photochromic paint are given.

QUALITY ASSURANCE. GUIDANCE TO NONDESTRUCTIVE TESTING TECHNIQUES

Army Materiel Command. April 1970. 179 pages.

AD–728 162

The advantages of nondestructive testing (NDT) and inspection methods make them most attractive as candidate quality assurance controls for materials, processes, and products. NDT methods, in addition to being by definition nondestructive, often readily lend themselves to 100 percent inspection requirements. It is the purpose of this handbook to provide those who are not familiar with NDT a basic and broad overview of the more common methodologies constituting this technology. For each method, information is provided concerning the scientific principles on which the method is predicated, the types of materials and item characteristics the method is generally used for, the equipment and standards normally associated with tests, method sensitivity, particular advantages and disadvantages, and any other information considered necessary to develop an understanding and appreciation of the NDT methods, and when and how such methods are used. The methods covered include: Visual inspection; liquid penetrant inspection; magnetic particle inspection; X- and gamma-ray film radiography; fluoroscopic and electronic X- and gamma-ray imaging systems; sonic and ultrasonic NDT; eddy current NDT; conductivity NDT; microwave NDT; infrared NDT; liquid crystal NDT; kryptonation NDT; corona discharge NDT; leak testing.

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NONDESTRUCTIVE EVALUATION OF METAL FATIGUE

Southwest Research Institute. F. N. Kusenberger, J. Lankford, Jr., P. H. Francis, and J. R. Barton. April 1971. 114 pages.

AD–728 637

Fatigue in metals has been known and investigated for almost a century. The phenomenon is now recognized to be a complex one and it has been laboriously studied using theoretical, statistical, and experimental approaches. This document relates efforts directed toward the development and evaluation of nondestructive evaluation (NDE) instrumentation techniques for determining the extent of fatigue damage in metals of engineering interest. Results are also given of basic studies of fatigue crack nucleation and propagation which provide a more complete understanding of the fatigue damage—NDE response interaction.

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A CAPACITIVE MEASUREMENT SYSTEM FOR THE NONDESTRUCTIVE TESTING OF FIBER GLASS REINFORCED PLASTICS

Stanford University. Strether Smith. January 1969. 33 pages.

AD–857 310

In spite of the fact that numerous processes for the nondestructive testing of reinforced plastic laminates have been tested, no combination of presently available test techniques can provide sufficient information to completely describe a specimen. The investigation described in the report was undertaken to assess the applicability of capacitive measurements. This principle has been neglected previously because of the apparent complexity and cost involved. A very simple, inexpensive device is described and a straightforward theory is derived. Although the method is still not a cure-all, it proves to be one of the most sensitive nondestructive tests yet developed to determine the thickness and resin content of reinforced plastic composites. Furthermore, the test can be performed essentially from one side of the specimen.

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INVESTIGATION TO DETERMINE THE FEASIBILITY OF DETECTING IMPENDING METAL FATIGUE FAILURE THROUGH USE OF AN INDUCTIVE SENSING DEVICE

Mechanical Technology Incorporated. George G. Moross. February 1970. 128 pages.

AD–871 155

Failure in mechanical systems is directly attributable, in many cases, to metal fatigue, a result of repetitive loading of the structure. With the advent of larger and more sophisticated mechanical systems, where failure may become catastrophic, a definite need has arisen for the development of reliable, nondestructive inspection methods for detecting fatigue damage and impending failure. A sensing system which will detect surface and near-surface flaws in material, specifically to detect early fatigue damage, has now been developed and evaluated. The system shows great promise in that a signal is detected at a significant time before failure, and the amplitude of the signal increases with further damage.

AN ULTRASONIC NONDESTRUCTIVE TESTER

General Electric Company. May 1970. 16 pages.

GEPP–80

There is wide need for simple nondestructive testing equipment which can be utilized for the evaluation of either raw materials or manufactured items. Ultrasonic methods are sought in particular in view of instrument size and lack of radiation hazards. The report describes the instrumentation and methodology of a semi-automatic device which has the capability of detecting flaws of smaller size in thinner materials and closer to front surfaces than commercially available systems. Testing components are discussed, including an axis manipulator, potentiometers, a transducer pulser, and electronic pulse receiver-detector, an immersion tank, and a set of profiling balls. The system is designed for manual operation of the scanning axes.

Nuclear Industrial Applications

I. STEELMAKING IN AN INDUSTRIAL COMPLEX. II. ACETYLENE PRODUCTION FROM NAPHTHA BY ELECTRIC ARC AND BY PARTIAL COMBUSTION

Oak Ridge National Laboratory. A. M. Squires and W. E. Lobo. November 1968. 32 pages.

ORNL–4294

The report provides the full text of two studies done in connection with the Nuclear Powered Agro-Industrial Complex Study Project, which is described in detail in the reports ORNL–4290 and 4291 (see the Jan. 1971 issue of AMTID). Part I reviews the recent history and presents the status of conventional steelmaking, and projects the probable direction of the industry over the next 10 to 20 years. It then describes a number of alternate routes to the manufacture of iron and steel which are likely to be more amenable to conditions in developing nations than the conventional blast furnace route. Partial cost estimates for all the alternatives indicate that all of these schemes will permit developing nations with iron ore resources to compete successfully in the world steel market. Part II compares the cost of acetylene (and ethylene) production from naphtha by the electric arc and the partial oxidation processes. The results indicate that with power at 4 mills/kwhr, the former process results in a 30% cost saving over the latter. Furthermore, it was found that the electric arc process is competitive at power costs up to 10 mills/kwhr.

PATENT LITERATURE ON PROCESS RADIATION AND IRRADIATOR DESIGN. PART I. UNITED STATES PATENTS 1950 THROUGH 1968

Oak Ridge National Laboratory. R. E. Greene, H. S. Warren, and P. S. Baker. June 1971. 293 pages.

ORNL–IIC–34

Process radiation may be defined as the use of high energy radiation from accelerators, x-ray machines, or radioisotopes in the production or processing of materials. As such, it is becoming an increasingly important tool in industrial operations. This document provides a survey of over 700 U.S. patents issued from 1950 through 1968 on process radiation and irradiator design. For each of the patents, the patent number, dates of filing and issue, assignee, patentee, and either an abstract or the most descriptive patent claim are given. Subject and assignee indexes are provided. and partial listings of 1969 and 1970 patents are appended.

Packaging and Containerization

MODULAR/INTERMODAL CONTAINER PARAMETRIC STUDY

Avco Systems Division. Peter S. Pusey and Kenneth Wreghitt. January 1970. 202 pages.

AD–725 099

The transport of several types of cargo may involve the capability of pickup, delivery, storage, batch breakdown or combination, special handling, and repackaging. Such multiple handling requirements are encouraging the development of containerization which can speed distribution and reduce costs. The document is particularly concerned with a concept in which a large container is made up from the assembly of smaller containers or modules. The report, however, presents the results of a study of a range of design variables, a simple analytical method being used to show the effects of weight and volume, design costs, materials such as steel, aluminum and fiberglass; constructions such as homogeneous and sandwich; and handling. The results of the analysis are presented in graphic form. Some of the topics discussed are tradeoff studies, mathematical analysis of deflections and stresses, linear and nonlinear background theory, reliability, and maintainability. The possible application of these factors to uses other than cargo transport is also included.

AN ASSESSMENT OF THE FLEXIBLE PACKAGING SYSTEM FOR HEAT-PROCESSED FOODS

Army Natick Laboratories. Joseph W. Szczeblowski. April 1971. 55 pages.

AD–728 465

The development of a replacement for the traditional tin-plated-can food container has been the objective of a great deal of effort in industry and the government. One possible replacement is the flexible packaging system for heat-processed foods. Such a package is intended to contain shelf-stable foods and to have been subjected to sterilizing temperatures as high as 250F, and pressure fluctuations common to the thermal processing of foods in glass and metal containers in a retort prior to shipment, storage, and consumption. Advantages of flexible packages, in comparison to metal cans include lighter weight, easier storage, availability of materials, and possibly greater shelf life. The report presents the results of an assessment of about 200 flexible packaging systems. The following aspects are considered: Materials, package design, bacterial penetration, processing, tests and procedures, shipment and storage, consumer handling, production capability.

AN EVALUATION OF ALTERNATIVE RAILROAD TERMINAL CONTAINER HANDLING SYSTEMS

Reebie and Associates Inc. Donald P. Ainsworth and David A. Isacowitz. March 1971. 77 pages.

COM–71–00398

Containerization in the transfer of goods has become a major development in world transportation in general and in overseas shipping in particular. The adoption of container technology is cited as a prime breakthrough in maritime industry. The document is concerned with container handling in railroad terminals servicing shipping ports, considering that most rail carriers prefer to handle marine containers as trailers. Some discussion is accorded this separation of cargo intended for intermodal handling. Terminal analysis includes cost statistics, transfer equipment, track and land facilities, labor, management, and buildings. Assumptions are drawn, and mathematical models are formulated. The final phase of the model development relates operating cost, opportunity cost, and capital recovery cost.

CONTAINER INTERCHANGE AND POOLING ARRANGEMENTS

Booz, Allen and Hamilton, Inc. June 1970. 223 pages.

PB–192 611

Traditionally, individual transportation modes have operated independently of each other; world commerce, however, requires intermodal containers which individual carriers can handle regardless of mode. The study identifies current technical and commercial methods of interchanging containers and pooling equipment. Feasible alternatives are evaluated for intra and intermodal facilities operated domestically and internationally. A relationship between pooling and interchange is established. Statistical data is presented for container unit estimates, commercial liner cargo tonnage in foreign trade, growth of United States foreign trade by major trade partners, interchange provisions and agreements, matrix analysis of pooling costs and benefits, and seasonal fluctuations. Guidelines are recommended for the use of trailer interchange receipts.

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Power Sources

SUBMERSIBLE DIVER TOOL POWER SOURCES; ELECTRO-HYDRAULIC AND CRYOGENIC PNEUMATIC

Naval Civil Engineering Laboratory. S. A. Black. August 1971. 41 pages.

AD–731 358

In the past, power supplies for diver tools have been located on surface support ships or at shore installations. As technology has increased the capability of divers to spend longer periods of time at underwater sites for purposes of construction or salvage, dependence upon surface support has become less satisfactory. Furthermore, depth increase is accompanied by hazard increase. Accordingly, self-contained submersible power modules are being sought which may either be located on the sea bottom or mounted on underwater vehicles. The report describes two experimental diver tool power sources for use in underwater construction and salvage missions. Both units are completely self-contained, submersible, and diver operable. One is a gas generating system which utilizes liquefied nitrogen as the energy source to power pneumatic tools for 15 minutes at a depth of 120 feet; two cryogenic circuits are incorporated. The other system utilizes lead-acid batteries as the energy source to power oil hydraulic tools. 36 volts are available for operation at depths up to 120 feet.

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AN INTRODUCTION TO FUEL CELLS

National Aeronautics and Space Administration. Ernest M. Cohn. 1970. 11 pages.

N69–72744

The report summarizes the state of the art and future prospects of fuel cells. The definition, classification, properties, systems, and uses of fuel cells are described. Also presented are the commercial problems, potential, and costs.

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THERMOELECTRIC GENERATOR DESIGN MANUAL

Teledyne Systems Corporation. B. Hiser, T. Christenbury, F. Russo, and J. McGrew. February 1970. 120 pages.

N70–25817

The production of electric current from a circuit composed of two conducting dissimilar materials having two junctions between the materials at different temperatures, known as the Seebeck effect, forms the basis of thermocouples and thermogenerators. The manual presents the salient features of thermoelectric generator design and analysis from the viewpoint of heat and charge transport. Topics discussed include the thermodynamics of thermoelectricity, thermoelectrical materials, thermoelectric design theory, computations, and design solutions. Chemical and structural characteristics of materials and interfaces are purposely not included. Particular coverage is given to the properties of materials and the performance characteristics of these materials when operating as thermoelectric couples.

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Safety

AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE SYSTEMS—CURRENT TECHNOLOGY REVIEW

IIT Research Institute. F. Salzberg and J. Campbell. October 1969. 138 pages.

AD–703 393

The document identifies current technology, technical gaps, future needs for research and development, and factors affecting operational requirements and employment of aircraft ground fire suppression and rescue systems. Specific areas of interest include: hostile flame characteristics, environmental influences on hostile fire and equipment capabilities, fire extinguishing agent and agent dispensing systems, aircraft fire-fighting trucks, aircraft ground fire extinguishers, rescue tools and equipment, aircraft forceable-entry tools and equipment, application of ground mobility concepts to suppression and rescue systems, runway foaming procedures and equipment, and fire-protective clothing as they apply to fire-fighting and rescue personnel.

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FIRE FIGHTER'S EXPOSURE STUDY

Cornell Aeronautical Laboratory. Kenneth W. Graves. December 1970. 90 pages.

AD–722 774

The effectiveness of protective garments in firefighting and fire rescue operations depends on knowledge of actual thermal conditions, so that garment design may provide safety with minimum bulk and maximum mobility. The purpose of the research was to investigate the thermal environment of jet and aviation fuel fires in order to facilitate protective clothing design. The document discusses important factors in fire behavior and personnel exposure, including area of fire spread, maximum rate of burning time, wind conditions, fuel types, shape of the fuel pool, and weather conditions. Flame temperatures and visual appearances are considered as incidental. Experimental fires from pools of burning aircraft fuels were instrumented to measure heat flux; test facilities on a level flat concrete pad are described. A means by which evaluation of reflective clothing can be made is presented.

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DEVELOPMENT OF HALOGENATED HYDROCARBON FOAM (HALOFOAM) EXTINGUISHANTS

Arthur D. Little, Incorporated. Sami Ataliah, Henry L. Buccigross, Irving J. Arons, and James R. Valentine. April 1971. 152 pages.

AD–882 997

The report describes the results of a study which concerned the development of a foam fire extinguishing agent superior to bromochloromethane (CB). A number of halogenated hydrocarbon foams (halofoams) were developed which proved more effective and less toxic than CB in extinguishing Types A, B, and C fires. They could all be used between –65 and 160F. The best possible substitute for CB was an extinguishant containing bromo-chloro-difluoromethane (Halon 1211).

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SAFETY AND MAINTENANCE ENGINEERING: A COMPILATION

National Aeronautics and Space Administration. 1970. 22 pages.

N71–33592

A number of safety innovations developed by or for NASA have potential applications outside of the aerospace industry. The items presented include those which may be classed as preventive maintenance. The document is divided into four sections: General Personnel Safety, Electrical Safety, General Equipment Safety, and Fire Safety. A form for requesting additional technical information is included.

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CONTROL OF THE DUST EXPLOSION HAZARD ON COAL MINE SHUTTLE-CAR RUNWAYS

Bureau of Mines. John Nagy, Edward M. Kawenski, and Edward A. Barrett. November 1970. 20 pages.

PB–196 600

Efforts have been directed toward the control of coal dust on shuttle-car roadways in coal mines in order to eliminate explosion hazards. Large scale tests in an experimental mine are described which show that such hazards may be controlled by proper application of water, dry rock dust, and ammonium phosphate. Various considerations involved in the use of this method are described.

MICROWAVE MEASUREMENTS AND NEW TYPES OF DETECTORS FOR EVALUATION OF HEALTH HAZARDS

Bureau of Radiological Health. Mays L. Swicord. January 1971. 45 pages.

PB–197 715

Concern over harm to the human body from microwave radiation has created a need for more information on electromagnetic field detection and measurement. The need has arisen because of the accessibility to industrial workers and the general public of microwave ovens, microwave diathermy, radar, and high powered antennas. The report discusses technical problems associated with microwaves in relation to hazard protection, and describes some of the instrumentation in current development and use for such purposes. Types of detectors and the response to various types of instruments are discussed.

INHIBITION OF COAL DUST-AIR FLAMES

Bureau of Mines. J. Grumer, and A. E. Bruszak. August 1971. 14 pages.

PB–203 662

In coal mining dust is produced at the face, at conveyors, at transfer points, and by the normal movement of men and machines. An explosion is often started by the burning of a relatively small pocket of flammable methane-air mixture. If this were the only quantity of fuel inflamed, such an explosion would cause relatively little and certainly localized damage. However, where coal dust is present on mine surfaces, such a small explosion of a gas-air mixture can disperse coal dust into the air and ignite the resulting cloud. In this case, the flame propagates into a flammable cloud which is generated as the flame advances. For this reason, nine dust and gaseous inhibitors of propagating coal dust-air flames (lean, stoichiometric, and rich) were evaluated. The inhibitors were rock dust (calcium carbonate), powdered oyster shells (calcium carbonate), Halon 1301 (trifluorobromomethane), Halon 1211 (difluorochlorobromomethane), sodium chloride, Super-K (potassium chloride), regular-grade fire extinguishant powder (sodium bicarbonate), Purple-K (potassium bicarbonate), and Monnex (potassium bicarbonate combined with urea). On the basis of the weight-percent required to inhibit coal dust flames, it was found that efficiency increases in the order shown above.

THE INFLUENCE OF YIELD STRENGTH AND FRACTURE TOUGHNESS ON FATIGUE DESIGN PROCEDURES FOR STRUCTURAL STEELS

Naval Research Laboratory. T. W. Crooker, and E. A. Lange. February 1970. 23 pages.

AD–702 737

An investigation is reported which deals with the fatigue failure of welded steel structures as an outcome of crack propagation. This type of failure is viewed as a crack growth process within fixed bouding conditions between two flaw sizes. The initial condition is a rapidly initiated or a preexisting flaw, and the terminal condition is a critical flaw and failure. A relation is studied between loading, time, and cyclic repetition which govern critical flaw size and fatigue life. The influence of yield strength and fracture toughness are described in relation to the plasticity which is involved in crack behavior. Plasticity is discussed under the headings of gross ductile yielding beyond the crack vicinity, large-scale localized yielding about a crack tip in a large elastic field, and small-scale localized yielding in a restricted zone about a crack tip. The report contains mathematical formulations, experimental data, and the results of test investigations of fatigue crack propagation, fracture toughness, and involved procedures. The treatment of high strength structural steels forms the focus of the study.

FRACTURE TOUGHNESS OF STRUCTURAL METALS

Naval Research Laboratory. E. A. Lange. May 1970. 29 pages.

AD–707 338

The document is concerned with the engineering aspects of failure-safe design, involving the use of conservative values for the mechanical parameters needed, and summarizes the present trends in fracture technology investigation. Discussions are presented on critical flaw sizes, plastic strain, and theoretical considerations. Conclusions are drawn regarding fracture toughness as a measure of performance of structures. Topics treated in detail include the mechanical aspects of fracture resistivity, microfractures in steels and nonferrous metals, and test methods for measuring fracture resistance. Analysis diagrams and performance criteria are given, with flexibility sufficient to allow for upgrading as the study of plastic instability proceeds.

A STUDY OF THE FEASIBILITY OF METHODS FOR INCREASING THE LOAD-CARRYING CAPACITIES OF EXISTING CONCRETE BEAMS

Army Engineer Waterways Experiment Station. Frank B. Cox. May 1970. 114 pages.

AD–709 586

In practically every type of protective structural engineering, an increase in the load-carrying capacity of parts is desirable; accordingly research is being undertaken on means of modifying and strengthening structures in order to obtain such increase. The primary objective of the investigation was to determine the feasibility of increasing load-carrying capacities of reinforced concrete beams by modifying their cross sections. The document describes a method of additional reinforcement by adhesive bonding of certain forms to the horizontal or vertical faces or both. The forms consisted of steel strips or sheets, precast reinforced concrete panels, or prestressed concrete panels, either singly or in combination. Several epoxy-resin systems were studied as a means of providing optimal bonding strength. The results of tests combining the most promising combinations are discussed, with especial attention to shear behavior and tensile reinforcement. Conclusions are drawn and recommendations are made for further research.

STRENGTH OF MULTIPLE-MEMBER STRUCTURES

Forest Products Laboratory. John J. Zahn. July 1970. 46 pages.

AD–709 704

Because lumber varies considerably in strength, it has been standard engineering practice to design load-carrying wooden structures as though all members were replicates of the lowest strength permitted, resulting in low efficiency of lumber utilization. As a result, search continues for feasible design stress revisions, an example of which is load-sharing. The document concerns an analysis of the effects of joining beams with a load-distributing element. Four sets of strength and stiffness data, obtained from grade surveys, are used as input information. A prototype structure has been evolved, bridged at midspan by a single deck element of weakest-link form and analyzed for loading. The theory developed is considered to be of permanent value, since it combines statistical and mechanical concepts which might be applied to other areas in which strength-size-reliability analysis is important. Features discussed include strain, brittleness, failure behavior, and deflection.

TESTS ON CONCRETE SHEET PILES WITH PLASTIC INTERLOCK

Army Engineer Waterways Experiment Station. Glen S. Orenstein. September 1969. 17 pages.

AD–731 875

Prestressed concrete sheet piles are widely used for a variety of reasons—economic, logistic, and structural—and require waterproofing between adjacent piles to prevent water seepage or seepage of loose materials such as sand or silt. The report covers a test program to determine the structural limitations of a newly developed plastic interlock-waterstop as a substitute for the usual method of grouting. The polyethylene interlock material was subjected to standard tests for strength, elongation, aging, and reactivity with detrimental elements. Sheet pile joint incorporating the plastic interlock were tested under the structural loadings of axial tension to failure, transverse shear to failure, combined axial tension and transverse sheer, and sustained axial tension for a creep type failure. Structural performance is discussed for several test specimens, along with a description of test technology and specimen configuration.

BEARING STRENGTH OF WOOD UNDER EMBEDMENT LOADING OF FASTENERS

Forest Products Laboratory. Thomas Lee Wilkinson. 1971. 13 pages.

AD–732 012

The interactions between mechanical fasteners such as nails and bolts with wood become of especial importance during high winds and seismic motions; accordingly hurricane and earthquake engineering involves the study of tensile loads on an anchoring fastener. The document is concerned with three factors of importance: Withdrawal resistance of the fastener from the foundation, tensile strength of the fastener, and embedment characteristics of the fastener into the wood. An investigation of these factors is reported with the view of providing data for design heretofore unavailable. Tests are described using short and long specimens of five species of wood; the types and dimensions of fasteners are tabulated; mathematical models for the relationships between loading and fastener are given for varying conditions of moisture and stress. Much of the data appears in graphic form, including load-embedment curves, deformation and maximum load curves, and specific gravity and compression relations curves.

CALCULATION AND DESIGN OF JOINTS MADE FROM COMPOSITE MATERIALS

Whittaker Corporation. Alberto Puppo, and Harold Evenson. May 1970. 108 pages.

AD–872 159

The document provides the elements for the rational design of joints made from fiber composite materials. The joint types considered include multiple-bolted joints, in-plane bolted joints, off-plane bolted joints, orthagonal joints, and lap joints. A finite element computer program, used to obtain stress distributions in composite joints, is included.

ON THE STRENGTH OF VARIOUS LAP JOINTS

Georgia Institute of Technology. W. H. Horton and C. C. Rogers. August 1970. 49 pages.

AD–875 736

The bonding of metal sheets by means of epoxy resins offers a promising alternative to riveting, fastening, and welding, since the glue joint permits a smoother transfer of load from one element to another than does the mechanical fastener. The research reported is part of a systematic experimental program dealing with joints, restricted to the behavior of simple overlapping joints in isotropic materials, in this case aluminum alloy strips bonded with a specification sheet glue in three lap lengths. Loading, stress, and failure test results are given for an investigation of the influence of lap length, the effect of taper in the adherends, and the effects of holes, adhesive thickness, voids, and particular geometric forms designated as bird mouths. The data are presented for the most part in graphic and tabular form.

WIND LOADS OF STRUCTURES. PROCEEDINGS OF USA-JAPAN SEMINAR

National Science Foundation, Japan Society for the Promotion of Science, University of Hawaii. October 1970. 380 pages.

PB–203 449

The document contains the papers presented at a seminar, held at the University of Hawaii during 19-24 October 1970, which was attended by engineers and meteorologists who had as their primary purpose the exchange of information on their activities in the area of wind loads on structures. Specific topics included: Wind damage and wind load problems; engineering climatology of wind speed; contribution of raindrops to wind effects in storms; comparative studies of urban and rural wind climatology; separation-induced pressure fluctuations on buildings; study of wind pressure effects with aerodynamic models; aerodynamic stability of suspension bridge deck sections; response of tall stacks to wind forces; techniques for measuring wind loads on full-scale buildings; dynamic response of free-standing towers to high-velocity winds; gust factors; effects of environmental loads on tall buildings; response of building skins to wind gusts; statistical prediction of structural performance in the wind environment; digital simulation of wind velocity.

Technology Transfer and Utilization

ON THE DIFFUSION OF INNOVATIONS RESEARCH TRADITION

Office of Research Analyses. Gustavo M. Quesada. November 1969. 48 pages.

AD–701 001

A continuing effort is being made to increase the level of understanding of the processes by which research results become utilized in technology. An innovation is defined as any idea, practice, or object perceived as new by the members of a social system. The report analyzes the decision-making process of the diffusion of technological innovations and attempts to make the analysis more meaningful by emphasizing the role of authoritarian, contingent, and collective types of decisions.

POLICYMAKING AND TECHNOLOGY TRANSFER: THE NEED FOR NATIONAL THINKING LABORATORIES

Rand Corporation. Samuel N. Bar-Zakay. December 1970. 24 pages.

AD–731 268

There is a need, particularly in the developing countries, for better policymaking and more efficient technology transfer. The document explores what is needed for this achievement. It is suggested that national thinking laboratories should be established to promote organized technology transfer and to act as catalysts to organized policymaking.

TECHNOLOGY TRANSFER MODEL

Rand Corporation. Samuel N. Bar-Zakay. November 1970. 31 pages.

AD–731 271

When scientific or technological information generated and/or used in one context is reevaluated and/or implemented in a different context, the process is called technology transfer. The report presents in detail a model of technology transfer with three objectives: To suggest a list of activities to be undertaken in a specified sequence by individuals and organizations intending to engage in a technology transfer project; to aid in the assessment of technology transfer projects by listing the elements involved in the process; and to point out topics in which more research is required. A bibliography of 55 references is included.

BIBLIOGRAPHY ON AUTOMATION AND TECHNOLOGICAL CHANGE AND STUDIES OF THE FUTURE

Rand Corporation. Annette Harrison. March 1971. 59 pages.

AD–731 649

The bibliography lists approximately 800 entries on automation and technological change in the social and physical sciences. The Appendix lists organizations engaged in future-oriented work.

TECHNOLOGICAL FORECASTING

Battelle-Northwest. S. R. Fields. June 1970. 68 pages.

BNWL–1466

Technological forecasting is becoming a widespread activity in business and government. It seeks to anticipate needs and objectives of the future and to plan research and development programs to meet these needs and objectives. A study is reported in which effort was concentrated on sorting out the various techniques available, selecting their best features, and forming them into a suitable procedure. A procedure is recommended which is based mostly on the use of relevance trees and the morphological approach to invention and discovery. A demonstration forecast was made to illustrate the use of the recommended procedure. It is concluded that this procedure has great potential for technological forecasting and advanced planning.

TECHNOLOGY ASSESSMENT—WHAT SHOULD IT BE

George Washington University. Guy Black. June 1971. 57 pages.

PB–201 471

Technology assessment is evaluation of change, whether or not the result of science and engineering. The document describes the status of the elements of technology assessment. A discussion is presented on establishing the existence of significant second-order relationships. Finally, the uncertainty of second-order consequences is discussed.

A TECHNOLOGY ASSESSMENT METHODOLOGY

Mitre Corporation. June 1971. 1,570 pages.

PB–202 778

The report is comprised of a set of seven documents which are concerned with the development of an analytical framework and a structured procedure that can be used for anticipating the social impacts of major technologies. The individual volumes of the set, which are available separately, are each summarized below.

A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 1. SOME BASIC PROPOSITIONS

Mitre Corporation. Martin V. Jones. June 1971. 307 pages.

PB–202 778–1

Until recent years, technological developments have evolved with little consideration being given to their impact on society. The increasing use of technology has engendered wide system impacts, thereby causing widespread concern over its effects on the individual and on the basic social structure itself. A standard, structured method has now been developed for making studies directed toward anticipating and influencing the societal impact of new technology applications. This volume describes the method itself. The other volumes in this series are 'pilot' assessment studies covering particular fields of technology that were conducted to help test, develop, and illustrate the standard assessment methodology.

A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 2. AUTOMOTIVE EMISSIONS

Mitre Corporation. Willis E. Jacobsen. June 1971. 205 pages.

PB–202 778–2

The report represents one of a series of pilot studies intended to help develop, test, and illustrate the generic technology assessment methodology described in Volume 1 of this series (see PB–202 778–1). It describes a framework for appraising societal influences of control strategies (both technological and nontechnological) for reducing noxious automotive emissions. Illustrative examples, based on a proposed cost/benefit model, are presented.

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A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 3. COMPUTERS—COMMUNICATIONS NETWORKS

Mitre Corporation. Hugh V. O'Neil. June 1971. 261 pages.

PB–202 778–3

The primary objective of this report is to assist in the development and illustration of the methodology for technology assessment described in Volume 1 of this series (see PB–202 778–1). As a secondary objective, the report integrates and evaluates the existing knowledge about the computer field. Many references, quotations, and exhibits from the literature are presented as background information, as well as to give a sample of the exploding volume of knowledge in the computer field. The technology covered centers on computer-communications networks, where each node in the network may be a simple terminal, a minicomputer, or a more advanced device. The report can serve as a point of departure for further efforts on the technological assessment of computers.

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A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 4. ENZYMES (INDUSTRIAL)

Mitre Corporation. David H. Rubin. June 1971. 226 pages.

PB–202 778–4

The understanding of enzyme processes and the application of enzyme technology could have a dramatic impact on industry, health, genetics, and society. These enzymes, by making chemical actions faster at lower temperatures and pressures, can greatly reduce the cost of present products or make entirely new products available. This report provides a review of the current state of the art relative to enzyme technology and a projection of likely trends in the next 10 to 20 years. An assessment is made of possible new applications for enzymes. A comprehensive impact analysis is also made of the good and bad effects of new enzymes on the health of production workers and consumers as well as on the environment, and the various public control options that would serve to maximize the benefits and minimize the ill effects of wider use of enzymes are evaluated. The study is intended to test and illustrate the general technology methodology described in Volume 1 of this series (see PB–202 778–1).

A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 5. MARICULTURE (SEA FARMING)

Mitre Corporation. Robert C. Landis. June 1971. 205 pages.

PB–202 778–5

Over the centuries man's greatest emphasis in satisfying the needs of sustenance has been in agriculture; however, within the past few decades increased emphasis has been placed on mariculture, or sea farming, as a possible technology for obtaining needed animal protein. This report explores a projected application and some of the expected impacts of mariculture in developing countries. Analyses are made of (1) the prospective application or mariculture in solving the problem of animal protein malnutrition and as a contribution to economic development; (2) the factors needed to stimulate and support mariculture application; and (3) probable production of luxury and nonluxury crops from the developing countries. Quantitative assessments are made of the economic impacts of mariculture and of certain society impacts due to mariculture, both in the 1975–1990 time frame. The report is written within the framework of the technology assessment methodology described in Volume 1 of this series (see PB–202 778–1).

A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 6. WATER POLLUTION: DOMESTIC WASTES

Mitre Corporation. Victor D. Wenk. June 1971. 331 pages.

PB–202 778–6

The complex cyclical relationships that exist between water as a natural resource, utilized for multiple purposes by multiple overlapping segments of society, and the degradation of our water resources in pursuit of these activities, provides the broad framework within which this pilot study in technology assessment is conducted (according to the methodology described in Volume 1 of this series, PB–202 778–1). The study focuses on a single category of water use, domestic utilization; and the primary issue addressed is the manner in which already utilized domestic waters and their accompanying wastes are conveyed from their point of origin, treated, and returned to some point in the total water-resource cycle. Within this issue, primary emphasis is given to the implications of technologies that allow collection, treatment, and disposal of spent domestic waste waters on an individual home or local basis as distinct from a centralized collection, treatment, and disposal approach.

A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 7. PROJECT SUMMARY

Mitre Corporation. Martin V. Jones. June 1971. 35 pages.

PB–202 778–7

In recent years there has been growing interest in developing a national technology assessment capability—a capability to anticipate and influence the societal impacts of new technology with greater comprehension and confidence. For this reason, a project was undertaken to develop an analytical framework and a structured procedure that could be used for assessing the impact of major technologies. The detailed results are reported in Volumes 1 through 6 of this series (see PB–202 778–1 through PB–202 778–6). This report provides a summary of the contents of those Volumes.

Transportation

A NONLINEAR INTEGER PROGRAMMING MODEL FOR EXPANDING THE TRANSPORTATION SYSTEM OF AN UNDERDEVELOPED COUNTRY OR REGION

Naval Postgraduate School. Bernard Michael Martin. October 1969. 67 pages.

AD–706 060

A mathematical model is developed and presented for maximizing the benefits that may be derived from expanding the transportation system of an underdeveloped country which seeks economic development. The benefits are described as direct or immediately recognized, and indirect or not immediately obvious. The discussion begins with the definition of an underdeveloped country or region; proceeds with the concept of a network of roads, highways, railroads, waterways, and air routes which may be represented in statistical form; and draws up the model using certain decision variables. Linear constraints and nonlinear objective functions are noted. A solution procedure for the model is suggested, and some recommendations are made.

FIELD FABRICATION OF CONTINUOUS LIGHTWEIGHT REINFORCED PLASTIC PIPE

Picatinny Arsenal. Arnold F. Molzon. June 1970. 29 pages.

AD–713 201

The document is concerned with the present need for lightweight pipe which can be produced in the field for the transportation fuel. Since the prefabricated pipe currently used is costly because of its weight and bulk, a continuous method of making sturdy plastic pipe would be of much benefit. The results of a literature search are presented, including data on the continuous production of polyester-glass pipe and another plastic type, petroleum compatibility, resin curing, pipe line engineering, and patents. Both theory and practice are reported on.

OPPORTUNITIES FOR COST REDUCTION IN THE DESIGN OF TRANSPORT FACILITIES FOR DEVELOPING REGIONS. VOLUME 1

University of California. March 1970. 229 pages.

PB–195 597

OPPORTUNITIES FOR COST REDUCTION IN THE DESIGN OF TRANSPORT FACILITIES FOR DEVELOPING REGIONS. VOLUME 2

University of California. March 1970. 221 pages.

PB–195 598

An examination has been made of transport facilities in the developing countries with a view to reducing the total initial and/or operating costs, or to reducing the costs devoted to the imported elements. Both economics and engineering aspects were considered in various model analyses. The study covered low-cost transportation technologies in the quest for techniques and design standards to serve developing countries at lower total costs in resources than are incurred with existing or traditional technologies. Specific aspects of the study covered in Volume 1 include: Road cost analysis and design standards; road construction cost model; selection of optimal road gradient; opportunities for cost savings in highway engineering design; the economics of one-way bridging; potential cost-savings in the design of water crossings. Volume 2 covers the following topics: Potential cost savings in the design and use of ground vehicles; opportunities for cost reductions in aircraft, airports, and airways; potential cost-savings in the selection of waterway and harbor techniques; harbors and associated facilities; economic models for choice of transport techniques in developing countries.

METHODOLOGY FOR RELATING HIGHWAY INVESTMENT TO REGIONAL ECONOMIC ACTIVITY

Faucett Associates. September 1970. 85 pages.

PB–196 522

The report is concerned with the economic effects of highway investments in terms of stimulation of consumer demand, changes in trade patterns, and cost considerations of goods and services. A multiregional input-output model is developed as a means of estimating these effects, especially in relation to predicting changes. Trade coefficients which are developed from published and unpublished data are analyzed using regression techniques. Three alternative models are discussed, using a numerical example, to show how a particular highway investment can affect regional economic activity. A few conclusions and recommendations are made in national and regional perspective.

SCHEDULING AND ROUTING MODELS FOR AIRLINE SYSTEMS

Massachusetts Institute of Technology. Robert W. Simpson. December 1969. 175 pages.

PB–196 528

The report is concerned with public air transportation systems operating mainly on a short haul network. A method is presented for developing optimization models for routing passenger transportation systems and for constructing schedules. Deterministic information and prediction information subject to some uncertainty are put together in computer models. By placing the problems all in one place, classifying them, and using a consistent notation, it is hoped that model relationships can be determined in order to facilitate model building and mathematical programming. Examples are cited in air traffic forecasting over a period of months in which schedule cycles by day or week are repeated without major changes, or in which no fixed schedule is maintained but real time is used to make adaptions.

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A STUDY OF THE SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACT OF HIGHWAY TRANSPORTATION FACILITIES ON URBAN COMMUNITIES

Washington State University. 1968. 216 pages.

PB–197 626

The report is concerned with the optimization of highway design, with a consideration of the several factors involved, including the relationship of automobile use to the city and the influence of freeways on city planning. A discussion is presented of route selection, freeway standards, public attitudes, urban area configurations, and highway types. Attention is given to neighborhood economic conditions and sociological impact. The results of analyses of low, medium, and high density residential areas, commercial, institutional, and industrial areas, recreational, central business district, and rural areas, and railway property and abandoned land are included. An effort is made to combine the various considerations so as to develop a desirability rating and a route selection methodology.

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1970 WORLD SURVEY OF CURRENT RESEARCH AND DEVELOPMENT ON ROADS AND ROAD TRANSPORT. A REPORT COVERING AN INVENTORY OF 59 COUNTRIES

International Road Federation. December 1970. 649 pages.

PB–197 492

The report concerns current research projects of 59 countries in the field of highway design, characteristics, and maintenance. Considerable attention is given to skid resistance of pavements, geometric standards for high speed freeways and for freeway interchanges, parking facilities, and the problems involved in right of way acquisition and relocation of persons and businesses. Construction methods and materials, structures, foundations, soil mechanics, and laboratory tests are also discussed.

OPPORTUNITIES FOR COST REDUCTION IN THE DESIGN OF TRANSPORT FACILITIES FOR DEVELOPING REGIONS. ANNEX TO VOLUMES 1 AND 2

California University. December 1970. 98 pages.

PB–198 035

A serious factor in the transportation facilities system of a nation is maintenance of its highways and roads; due care must be paid to roadside clearing, the upkeep of culverts and ditches, bridges, road surfaces, lane striping, signs, and traffic control devices, disaster engineering, and snow and ice removal. The annex supplements PB–195 597 and PB–195 598, which are described above. Research is focused on economic and engineering aspects of low-cost road construction. A mathematical model is provided for road maintenance cost estimation, including the variables of time, climate, and traffic volume. Consideration is given to the treatment of materials, such as concrete, steel, wood, sand, paint, and preservatives.

AN URBAN TRANSPORTATION BIBLIOGRAPHY

Urban Mass Transportation Administration. May 1971. 109 pages.

PB–199 031

The bibliography contains abstracts of reports, studies, articles, and monographs concerning urban transportation. Subject, author, and organization indexes are included. The bibliography is designed for use by government officials, transportation planners, industry leaders, consultants, researchers, and students. Many of the documents listed are available from NTIS.

BUS DESIGN: CONCEPTS AND EVALUATION

Rensselaer Research Corporation. 1970. 215 pages.

PB–203 908

This report describes a program which developed a practical transit bus design to meet the needs of passengers, community, system operators, and vehicle manufacturers. While the program was directed primarily toward the development of a small bus for use in low density suburban areas, the work can be applied to a full range of bus vehicle sizes. The report presents vehicle design criteria, vehicle design evaluation, bus operations, design considerations, and a sample bus design.

AN INFORMATION SYSTEM FOR IMPROVING THE EVALUATION OF NONMARKETED OUTPUTS

Institute for Water Resources. James D. Evans. July 1971. 55 pages.

AD–727 705

Water resource projects produce benefits which contribute to many private and public objectives but which cannot be adequately evaluated in monetary terms. The report is concerned with obtaining some means of evaluation to serve as a guide in investment decision making, noting that the fields of public investment theory and practice do not provide a unit of value for nonmeasurable, or noncommensurate, benefits. While the emphasis of the study is on the evaluation of selected outputs not exchanged in the market, the aim is to develop a framework which may be useful in evaluating all types of nonmarket benefits. An information system is discussed which includes benefit-cost analysis of a particular problem at hand, planning concepts involved, constraints imposed by planners' attitudes and professional skills, information display systems and data banks, and regional environmental factors.

SUBSURFACE AND TRICKLE IRRIGATION, A SURVEY OF POTENTIALS AND PROBLEMS

Nuclear Desalination Information Center. Thomas E. Cole. November 1971. 73 pages.

ORNL–NDIC–9

Trickle irrigation is the application of water at the soil surface so that it moves by capillarity into the root zone of the crop: subsurface irrigation is similar procedure with the water being applied under the soil surface. Both methods are applicable to all types of soil. The document emphasizes the fact that the choice of rates and locations of the water application are essential so that plant demand can be supplied with significant losses downward and soil moistness maintained below the surface to minimize surface losses due to evaporation. Such technology is especially important for locations where water is scarce or expensive for the production of high-value crops. Potential benefits are cited in water, crop, and labor savings, fertilizer, weed control, and insection control cost savings, and the possible use of saline water. A discussion is given of design and application problems, including the water movement in soils, hydraulic flow and tubing considerations, installation methods, and operation methodology.

GUIDELINES AND CRITERIA FOR COMMUNITY WATER SUPPLIES IN THE DEVELOPING COUNTRIES

Bureau of Water Hygiene. 1969. 108 pages.

PB–189 255

The report is an outgrowth of the conclusion that water supply management in the developing countries cannot be given outside aid until the right technology, competent administration, and skilled manpower are blended into well-conceived projects. Accordingly, a synthesis of ideas is made on guidelines and criteria for twelve countries: Brazil, Costa Rica, El Salvador, Guatemala, Honduras, Korea, Nicaragua, Pakistan, Panama, Peru, Philippines, and Thailand, leading to practice which may be applicable to the other developing countries. A discussion is given of standards and financing, community considerations, policies, laws and institutions, program planning, sources and management of funds, specifications, contracts, and construction, plant operation and maintenance, utility administration, and the development of public support.

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MINIMUM DESIGN STANDARDS FOR COMMUNITY WATER SUPPLY SYSTEMS

Federal Housing Administration. July 1965. 76 pages.

PB–189 258

The document contains the minimum design standards which apply to central water systems serving residential neighborhood developments and multifamily projects. The objective of the standards is to establish facilities which will deliver water which complies with chemical, physical, and bacteriological requirements, and which at the same time is palatable without being excessively hard or corrosive. It is meant for these standards to apply to uncompleted work as well as proposed systems at the time of mortgage request. Reported are such topics covered include source of supply, including sources of pollution and well construction methods, water treatment facilities, disinfection, water clarification, iron and manganese removal, water softening, corrosion control, taste and odor control, pumping and storage facilities, and distribution systems.

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COMPLEMENTARY—COMPETITIVE ASPECTS OF WATER STORAGE

Sacramento State College, Department of Civil Engineering. Kenneth D. Kerri. December 1969. 194 pages.

PB–190 197

When water is stored and subsequently released for water quality control, two conflicting situations arise. First, released water enhances downstream beneficial uses of water dependent on water quality and higher flow. Second, stored water provides a head for the production of hydroelectric power, and improves reservoir recreation and fishing. A competitive relationship also develops between the downstream demands for water to be diverted to such needs as irrigation. An analytical model has now been developed and tested that is capable of indicating the value, extent, and magnitude of the complementary and competitive aspects of water storage. A daily streamflow model and a relationship between reservoir operation and public utilization of the impondment (for fishing, recreation, etc.) were also developed which permit an accurate simulation of a water storage system. Planners, designers, and operations personnel are thus provided with a method of allocating water in proposed and existing systems.

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A MULTISTRUCTURAL DEMAND MODEL FOR WATER REQUIREMENT FORECASTING

Oklahoma University. George W. Reid. January 1970. 265 pages.

PB–190 813

In the management of water supply, the demand considerations of naturally dry areas, are of especial importance in regional planning and forecasting. Designing for the future, involving dams, waterways, treatment plants, pipelines, and distribution systems, requires reliable estimating methods. A multistaged, multivariant, and computerized mathematical model has now been developed for forecasting water requirements. The basic model uses both demographic and economic inputs, and is adaptable to various techniques or procedures for producing municipal and industrial needs. It is built on a national base, has been used on a major city, and is useful for other essential services such as sewage, transportation, and housing.

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WATER ADMINISTRATION—A SUGGESTED INSTITUTIONAL MODEL

Nebraska University. Clayton K. Yeutter. December 1968. 33 pages.

PB–193 024

A report on water management is presented from the point of view that the best time to solve water problems is before costly irreversible errors are made, and that proper water law is preventive rather than curative. An institutional model for water administration is described which aims for a basic and general framework for control through the construction of a water code incorporating simplicity, flexibility, and local responsibility. The document discusses a market model approach that allows most water allocation decisions to be made by the market, displaces the market only where the market cannot perform satisfactorily, and localizes non-market decision-making responsibilities whenever feasible.

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WATER MEASUREMENT PROCEDURES

Bureau of Reclamation. J. C. Schuster. September 1970. 59 pages.

PB–195 275

The document is intended for use as a teaching aid for presenting the fundamentals of water measurement to field personnel engaged in irrigation work. Technical material has been simplified to provide a clear understanding of water measurement devices and procedures. Topics include: Standard and nonstandard devices; basic principles of water measurements; some basic hydraulics; general aspects of water measurement accuracy; basic water measurement devices and techniques; Venturi flumes; metergates; special measuring devices and techniques.

WATER QUALITY MANAGEMENT PROBLEMS IN ARID REGIONS

Robert S. Kerr Water Research Center. James P. Law, Jr., and Jack L. Witherow. October 1970. 109 pages.

PB–198 125

The document reports on an international conference on arid lands of the world, presenting a group of papers concerned with water quality management in dry regions. One of the subjects was the incidence of new problems created by the solution of old ones, such as how to dispose of the saline agricultural wastewaters that result from irrigated agriculture. Consideration was given to canals to drain the water away, and processes to remove nitrates from it. Other papers dealt with the effects of salinity standards on irrigation programs, problems of pollution of irrigation waters, water quality requirements and the reuse of wastewater effluents, a demonstration project on salinity control in return flow, water quality control problems in inland sinks, natural pollution in arid land waters, distillation of wastewaters, and animal waste runoff.

WATER RESOURCE SYSTEM OPTIMIZATION BY GEOMETRIC PROGRAMMING

Texas A and M University, Water Resources Institute. W. L. Meier, Jr., C. S. Shih, and Duane J. Wray. February 1971. 126 pages.

PB–199 645

Water resource planners and systems analysis are continually confronted with many complex optimization problems. This report describes a new optimization technique which can be extremely useful in solving such problems. This potentially powerful technique is called geometric programming. It is one of a class of mathematical programming techniques. In order to study the use of geometric programming in practical problem solving, a computer algorithm was developed. A variety of water resources problems were solved using the algorithm. The report includes a tutorial explanation of geometric programming, a description of the computer algorithm used, a description of a water filtration cost model, and an explanation of the use of geometric programming in an application.

ARSENIC AND LEAD IN WATER. A BIBLIOGRAPHY

Water Resources Scientific Information Center. September 1971. 85 pages.

PB–202 578

The report is comprised of abstracts of publications dealing with all aspects of arsenic and lead in natural waters. An index is included. Some of the publications listed are available from NTIS; others are in the open literature.

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VALUE OF DESALTED WATER FOR IRRIGATION

Bureau of Reclamation. E. S. Krous, J. P. Wagner, W. A. Fernelius, John T. Maletic, and Harold L. Parkinson. October 1969. 181 pages.

PB–203 124

The advent of practical means of desalting saline waters provides a new potential source of irrigation water for arid regions. This document relates the results of a study to determine the costs and benefits associated with progressive decreases in the salinity of irrigation water supplies obtained through the use of two desalting techniques: multistage flash distillation and electrodialysis. The possible means of introducing desalted water into irrigation supply systems are identified, and efforts are made to relate current desalting technology to potential applications in agriculture. In general, benefits were found to exceed costs in a number of the possible combinations studied.

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WATER QUALITY STANDARDS AND INTERNATIONAL DEVELOPMENT

Agency for International Development, Office of Science and Technology. October 1971. 32 pages.

PB–204 408

There is a deepening appreciation of the value of clean water for tourism, industrial, and agricultural purposes, as well as for household uses. The requirements of these applications demand the development of water quality criteria based on scientific techniques and data. The intent of this report is to provide officials concerned with environmental policies with an insight into the concept of water quality standards, and to summarize the progress to date in establishing such standards in the United States and in developing countries. Specific topics include: Water supply standards; status of community water supply systems; drinking water standards; and surface water quality control.

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Prices of the reports, listed by order number, appear on page 117.

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IMPROVED CUPRIC AMMONIUM CARBONATE LEACHING OF COPPER SCRAP

Bureau of Mines, Salt Lake City Metallurgy Research Center. W. L. Staker, C. J. Chindgren, and K. C. Dean. 1971. 13 pages.

PB-204 131

Alternatives were developed to the conventional ammoniacal carbonate leaching procedure for recovering copper from contaminated scrap metal. The improvements included: (1) The use of gas-bubble entrainment (air or nitrogen) to create a turbulent flow through the material being leached, (2) the use of elemental sulfur to oxidize the cuprous copper in solution and precipitate it as a sulfide, and (3) the combined use of bubble entrainment and elemental sulfur. These improvements, which accelerate the leaching rate, potentially cut the cost of ammoniacal leaching by making possible the use of smaller, less costly equipment to produce a high-grade copper sulfide product.

—o—

RECOVERY OF COPPER FROM CONVERTER SLAGS BY FLOTATION

Bureau of Mines, Salt Lake City Metallurgy Research Center. V. E. Edlund, and S. J. Hussey. 1971. 17 pages.

PB-204 133

The bulk of the world's output of copper is produced by smelting copper sulfide flotation concentrates in reverberatory furnaces, followed by oxidizing the matte to blister copper in a converter. Slags produced in the converter are too high in copper to be sent to the dump and are returned to the reverberatory furnace for recovery of most of the copper. This method for re-treating converter slag, although simple, complicates the operation of the reverberatory furnace and contributes significantly to loss of copper in the reverberatory slag. An economic method for re-treating converter slag separately would increase furnace capacity, produce a lower-grade discard slag, and simplify furnace operations. Laboratory batch flotation tests were conducted on copper converter slags to evaluate the relative merits of recovering copper from slow-cooled versus water-quenched slags. Grindability studies were made on the respective heat-treated slags. Quenched slags proved more difficult to grind than slow-cooled slags. Cost studies showed that the cost of slow cooling and crushing offsets any advantages of higher copper recoveries from slow-cooled slag, and water-quenched slag, which requires no crushing preparatory to grinding, could be treated more economically.

—o—

BENEFICIATION OF HIGH-CLAY POTASH ORES BY FLOTATION

Bureau of Mines, Tuscaloosa Metallurgy Research Laboratory. Arthur B. Johnson, Jerome O. Crabtree, Thomas L. McVay, and Paul E. Bennett. September 1971. 16 pages.

PB–204 150

There is no substitute for potassium compounds in agriculture; they are essential to maintain and expand food production. Potash is found throughout the world in both soluble and insoluble forms. Only the soluble forms are economically attractive to process, primarily as chlorides and sulfates, and potassium chloride is by far the most important potash salt. As high-grade, low-clay-content ores are depleted, high-clay, low-grade ore reserves remain. These ores, containing 13 to 22 percent K2O and 3 to 7 percent clay slimes, cannot be effectively processed by current commercial flotation methods because of their high slime content. Newly developed physical beneficiation techniques for recovering potash minerals and the development of ore-dressing systems by flotation have now resulted in obtaining acceptable product grades and recoveries. By using a coarse grind, emphasis was placed on production of premium granular and coarse products. Flotation results showed that concentrates of 58.7 to 60.4 percent K2O with recoveries of 71.0 to 83.4 percent of the K2O values can be obtained.

OXIDATION PROCESS FOR IMPROVING GOLD RECOVERY FROM CARBON-BEARING GOLD ORES

Bureau of Mines, Reno Metallurgy Research Center. B. J. Scheiner, R. E. Lindstrom, and T. A. Henrie. 1971. 19 pages.

PB–205 500

The presence of carbon and organic compounds that inhibit gold recovery from auriferous ores has long plagued the cyanide mill operator. Unfavorable gold extraction in these ores has been attributed, in large part, to the adsorption of the gold cyanide complex on the carbonaceous matter, with subsequent loss to the tails. Extensive deposits of oxidized and organic carbon-containing gold deposits occur throughout the world. The report describes the development of an oxidation method for pretreating carbonaceous ores so that gold can be recovered by cyanidation. A variety of oxidants was shown to be effective in improving gold recovery, including chlorine and sodium hypochlorite (NaOCl). An electrolytic oxidation process was developed that was particularly advantageous from an economic and effectiveness standpoint.

COMPARISON OF TECHNIQUES FOR ELECTROWINNING TUNGSTEN FROM SCHEELITE

Bureau of Mines, Reno Metallurgy Research Center. John M. Gomes, Kenji Uchida, and M. M. Wong. 1971. 16 pages.

PB–205 506

Past investigations have demonstrated techniques for the electrowinning of tungsten directly from scheelite concentrate. The major problem with direct electrowinning is the accumulation of lime (CaO) in the electrolyte. Scheelite mineral concentrates usually contain 60 to 70 weight-percent WO3 and about 20 weight-percent CaO. The results of the CaO buildup are decreased metal purity, increased electrolyte viscosity, and decreased metal adherence to the cathode. Two techniques were investigated for removing CaO from scheelite (CaWO4) prior to electrolysis. In the first technique, a crude tungstic oxide (WO3) containing 0.15-percent lime (CaO) was prepared by digesting scheelite concentrates in hot hydrochloric acid. This oxide was used as cell feed to produce tungsten of 99.9-percent purity. The second technique used a high-temperature, two-phase separation, resulting in extraction of 99 percent of the WO3 in the halide-tungstate phase, while 90 percent of the CaO was retained in the silicate phase. Tungsten of 99.9-percent purity was deposited from the halide-tungstate melt after B203 and NaPO3 were added to form an electrolyte. The two methods were compared with a previously developed technique of depositing tungsten from scheelite concentrate fed directly to the electrolytic cell.

EXTRACTION OF MOLYBDENUM FROM ORES BY ELECTROOXIDATION

Bureau of Mines, Reno Metallurgy Research Center. B. J. Scheiner, and R. E. Lindstrom. January 1972. 12 pages.

PB–206 893

Classic flotation and roasting procedures for recovering molybdenum oxide from molybdenum source materials frequently result in low recovery of molybdenum. The yield of rhenium, which is intimately associated with molybdenite, is also correspondingly low. A high-yield electrooxidation technique has now been developed for extracting Mo and Re from ores and concentrates. Extractions of 90 to 99% Mo and 95 to 99% Re are obtained. In addition, the two metals can be selectively dissolved from concentrates containing copper minerals. Power consumption for the process in its present state of development is in the range of 16 to 24 kwhr per pound of Mo extracted.

Chemical Analysis

MICRO AND SEMIMICRO PROCEDURES FOR THE DETERMINATION OF CARBON AND HYDROGEN IN ORGANIC COMPOUNDS

Edgewood Arsenal, Analytical Chemistry Department. Marjorie F. Buckles, and J. W. Erna. July 1968. 41 pages.

AD–842 586

The determination of carbon and hydrogen in organic compounds is basic in a microanalytical laboratory; it is probably the most important analysis, and it is certainly the most frequently performed. Micro and semimicro procedures and equipment for the determination of carbon and hydrogen are described in detail. Methods are based on the conventional combustion approach with gravimetric finish, but modifications are numerous and were developed primarily for successful analysis of compounds containing C-P bonds in the presence of fluorine. These procedures give satisfactory results for a wide variety of structural types.

CHEMICAL SPOT TESTS FOR ALUMINUM ALLOYS

Bureau of Mines, College Park Metallurgy Research Center. A. W. Maynard, and D. A. Wilson. August 1971. 15 pages.

PB–203 655

The development of improved methods for the rapid identification of aluminum alloys is part of a study connected with the reuse of aluminum-containing scrap. It is important to know the type of alloy in order to facilitate its recovery. Simple chemical spot tests for the identification of major alloying elements in aluminum-base alloys are described. The tests are suitable for use by nontechnical personnel working outside a laboratory. Tests for zinc, copper, manganese, and magnesium employ electrographic sampling methods and sample papers. Differentiations between magnesium and magnesium-silicon alloys of aluminum and between aluminum-base and magnesium-base alloys are made by direct chemical solution tests. Description of a device for obtaining reliable electrographic samples is included. A sequence of testing for identification by alloy groups is given.

Desalination

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE–4

Oak Ridge National Laboratory, Nuclear Desalination Information Center. K. O. Johnsson. November 1969. 63 pages.

ORNL–NDIC–6

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE–5

Oak Ridge National Laboratory, Nuclear Desalination Information Center. K. O. Johnsson. September 1970. 59 pages.

ORNL–NDIC–7

INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE–6

Oak Ridge National Laboratory, Nuclear Desalination Information Center. September 1971. 91 pages.

ORNL–NDIC–10

In the past several years there has been an increased interest in applying nuclear energy to the dual purpose of producing electric power and desalting sea water or inland brackish water. These three documents reflect some of that interest with respect to the desalination portion of such operations. They contain bibliographic data and abstracts for approximately 735 recent publications, articles, and patents. The subject areas covered include: Energy sources, energy utilization, sea water distillation processes, other desalting processes, overall plant studies, siting considerations, industrial applications, and water utilization. Subject and author indexes are included.

TITLE–AUTHOR–COMPANY INDEX TO REPORTS PUBLISHED BY THE U.S. DEPARTMENT OF THE INTERIOR, OFFICE OF SALINE WATER, THROUGH JULY 1971

Oak Ridge National Laboratory (AEC), Nuclear Desalination Information Center. K. O. Johnsson. October 1971. 93 pages.

ORNL–NDIC–11

A major portion of water desalination research in the United States is done under the sponsorship of the Office of Saline Water. As of July 1971, approximately 700 reports had been generated as a result of the research. This document presents a word-by-word alphabetical index of these reports prepared with the aid of a computer from their titles, authors, and associated report numbers. The reports listed have either been published in technical journals, or are available for sale by the U.S. Government Printing Office and NTIS. This document supersedes ORNL–NDIC–8, which was described in AMTID, April 1972, page 6.

ECONOMICS OF SEAWATER DESALTING IN COMBINATION WITH AMMONIA AND POWER PRODUCTION

Bresler Chemical Engineering Associates. Sidney A. Bresler. August 1969. 145 pages.

PB–203 269

The purpose of the study is to examine the feasibility of lowering the operating cost of producing desalted water by combining its production with that of ammonia (one of the three basic fertilizer materials), and also of electricity, through: The recovery and utilization of the low temperature heat which, in conventional ammonia manufacturing processes, is dissipated to cooling water and thence to the atmosphere; The employment of a common energy center for the production of the high temperature heat needed both for the reforming of natural gas to produce an ammonia synthesis gas, and for the production of high pressure steam. (High pressure steam is used to drive the large ammonia plant compressors. It may also be used to drive the vapor compressors of a vapor compression-vertical tube evaporation plant for the production of desalted water, or to drive turbo-generators). The use of a common energy center permits the design of plants having a wide range of relative capacities of ammonia, desalted water and/or electric power, resulting in further possible reductions of unit water costs. The use of nuclear energy starts to become economically attractive when the cost of natural gas or other hydrocarbon fuel exceeds 25 cents per million BTU.

* * *

STABILIZATION OF PRODUCT WATER FROM SEAWATER DISTILLATION PLANTS

Oak Ridge National Laboratory. C. D. Bopp, and S. A. Reed. July 1971. 50 pages.

PB–204 623

Untreated product water from a seawater distillation plant will rapidly attack the construction materials that are commonly used in water storage and distribution systems. The pure distillate will dissolve the free lime in concrete and cause it to deteriorate rapidly. Similarly, it will remove the protective film from steel water lines that have been in service for many years and prevent protective film formation on new mains, Leaving bare metal surfaces which can corrode at rates in excess of 10 mils per year. The usual approach to pacification of unusually soft natural waters is the addition of controlled amounts of phosphates and/or silicates and in some cases calcium to form protective films on the metal piping surfaces. Distillate from a desalting plant is essentially devoid of all ions and dissolved gases and, consequently, all the scale forming materials must be added. The optimum (minimum) quantities needed to make the water innocuous to distribution systems must be established. This document (1) summarizes past work that has been carried out on stabilizing desalting plant distillate, (2) reviews the current state-of-the-art on treating desalting plant product, (3) reviews the pertinent literature related to treating naturally soft water to prevent corrosion, and (4) recommends a treatment method that appears to be optimum from the standpoint of both cost and overall effectiveness for the prevention of corrosion of materials normally used in water storage and distribution systems.

* * *

SOLAR DISTILLATION UTILIZING MULTIPLE-EFFECT HUMIDIFICATION

University of Arizona. C. N. Hodges, T. L. Thompson, J. E. Groh, and D. H. Frieling. May 1966. 174 pages.

PB–206 068

The report describes investigations which were undertaken to determine the technical feasibility of a distillation process using solar energy as a heating source in an evaporation-condensation cycle. Secondary objectives were the determination of the most suitable equipment for each component in the system and an evaluation of the effect of size and design on the economics of the integrated system. In this system, sea water is heated as it flows through a condenser and solar collectors. Storage tanks are used, to permit the evaporator and condenser to be operated on a 24-hour basis since the solar collectors are only used during the period of sunshine. The hot sea water is distributed into the evaporator where a counter-current air stream is humidified and transports vapor from the evaporator to the condenser. Liquefaction of the vapor in the air-stream results in the distillate production. The evaporator-condenser combination is termed a "humidification cycle," as the air-stream is humidified in the evaporator and dehumidified in the condenser. The equipment is designed to provide a temperature increase of the brine in the condenser several times that in the collectors. The term multiple-effect as used here is the ratio of the energy used for distillate production to the energy input to the collectors. A pilot plant was constructed and operated at Puerto Penasco, Sonora, Mexico. The pilot plant produced over 3,000 gallons per day of distilled water from a 10,400 square feet of solar collector area. A preliminary economic analysis is given which compares projected tests with those of the simple solar still.

* * *

U.S. PATENT ABSTRACTS AND INDEXES COVERING THE TECHNOLOGY OF DISTILLATION PROCESSES FOR SALINE WATER CONVERSION

Oak Ridge National Laboratory (AEC). K. O. Johnsson. July 1971. 92 pages.

PB–206 452

Abstracts are provided for approximately 400 U.S. patents pertaining to the distillation process for converting sea water or brackish water to potable water. Subject author, and patent number indexes are included.

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A MANUAL ON WATER DESALINATION. VOLUME ONE. TECHNOLOGY

Kaiser Engineers. April 1967. 322 pages.

PB–206 549

Advances in desalination technology have reduced the cost of desalting seawater and brackish water to where, in certain areas, it is competitive with the cost of water obtainable from new natural water supplies. This manual has been prepared as a guide in evaluating the feasibility of desalination in water-short areas where desalination may be competitive with other water sources. The manual is divided into two volumes, which may be used independently of each other. Volume 1 includes a discussion of the state-of-the-art of the major desalination processes. Specific topics include: Saline water phenomena and definitions; state-of-the-art of distillation, freezing and crystallization, electrodialysis, and reverse osmosis processes; description of typical plants; dual-purpose electric power generation-water desalination plants; recovery of chemicals as by-products; summary of major conceptual design studies.

A MANUAL ON WATER DESALINATION. VOLUME TWO. ECONOMICS

Kaiser Engineers. April 1967. 179 pages.

PB–206 550

This second volume of a two volume manual provides guidelines for the initiation of a program for defining and solving the water shortage problems of a particular nation or region. Its scope includes the formulation of a logical and feasible water development plan; the accomplishment of preliminary feasibility studies on the possible solutions, and the determination of the most promising course of action based upon the results of these studies; and the accomplishment of a detailed engineering feasibility and economic study of the possible alternatives. A series of estimating aids and nomographs for determining capital costs of desalination plant facilities is included.

SCALE CONTROL FOR SALINE WATER CONVERSION DISTILLATION PLANTS

Baldwin-Lima-Hamilton Corporation. Robert A. Tidball, and A. N. Rogers. April 1966. 18 pages.

PB–207 006

The cost of potable water produced by saline water distillation plants is strongly influenced by "economy" or distillate to prime steam ratio. The major factor contributing to good economy is the ability of the plant to operate with a large temperature differential between the prime steam and the final brine flashing temperature. Because sea water deposits a scale which inhibits heat transfer when heated above 170°F, the maximum economy practical with untreated sea water was low. As a result of research into general scale inhibitors over many years, it became practical to operate at temperatures up to 200°F with acceptable cleaning requirements. Tests were performed to evaluate six scale control methods. Five were used with a six-stage flash plant—proprietary anti-scaling compounds, calcium carbonate sludge recirculation, calcium sulfate sludge recirculation, sulfuric acid with calcium sulfate sludge recirculation, and pH control. The sixth method, pH control with hot-end calcium sulfate sludge addition, was tested in a long tube vertical evaporator. Two of the methods were successful—pH control with sulfuric acid and sulfuric acid control with hot end calcium sulfate sludge addition. Engineering drawings and data are presented.

RESEARCH ON PUMPING UNIT STUDIES. FINAL EVALUATION REPORT

Bureau of Reclamation. September 1966. 52 pages.

PB–207 010

It is envisaged that desalination plants of 50-million-gallons-per-day capacity and larger will be constructed for the purpose of supplementing the water supply of coastal cities by resorting to the ocean for a source. This report represents an evaluation of data on large pumping units which are capable of withstanding aerated sea water and hot brine solutions to be encountered in such plants. The data include: Setting requirements; motor costs and weights; pump materials; pump costs; and efficiency. A recommended procedure is given for selecting and pricing pumps, and for determining the required setting.

EVALUATION OF CONCRETE AND RELATED MATERIALS FOR DESALINATION PLANTS

Bureau of Reclamation. May 1968. 44 pages.

PB–207 030

The economic feasibility of large-scale desalting plants is in part dependent upon the development of improved designs in the use of construction materials which can lead to substantial cost reduction. The extensive use of concrete and related materials has been proposed as a cost saving item. This report documents a series of studies which were undertaken to help fill the gaps in knowledge of the use of concrete construction under the conditions of temperature, pressure, salinity, and structural stresses that exist in an evaporator-type desalting plant. The studies included: Evaluation of concrete containing both natural and limestone coarse aggregate and natural fine aggregate under a variety of temperature-pressure-brine concentration conditions; concrete panel and model structural studies; selection and evaluation of accessory coatings, sealants, and polymeric products; concrete reinforcement materials; and concrete microstructural investigations.

PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE

Monsanto Research Corporation. B. M. Fabuss, and Alexander Korosi. 1968. 136 pages.

PB–207 087

This data book on water, aqueous electrolyte, and sea water properties is based on a review and evaluation of the available literature, as well as on original investigations. The work was motivated by a need for such data in desalination research. Density, vapor pressure, and viscosity are tabulated for: water; binary solutions (NaCl-KCl, Na sulfate, Mg sulfate); ternary solutions (NaCl-KCl, NaCl-Na sulfate, NaCl-Mg sulfate); and sea water and its concentrates. Thermal conductivity data of water and sea water, as well as boiling point elevation for sea water, are also given. A FORTRAN computer program is included which is generally applicable to calculate densities, activities, and viscosities of brines.

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Inorganic Chemicals

DATA COMPILATION ON VANADIUM OXIDES

Hughes Aircraft Company, Electronic Properties Information Center. M. Neuberger. November 1971. 64 pages.

AD–734 596

The change in crystal structure at the transition temperature in several of the vanadium oxides causes a drastic change in resistivity as the material is heated (or cooled). This phenomenon is being applied to the manufacture of a number of devices. All available information on the crystal structure, physical, mechanical, thermal, optical, magnetic, and electronic properties of bulk and film samples is tabulated in this compilation. Graphs illustrating these features are included.

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GALLIUM ARSENIDE. A BIBLIOGRAPHIC SUPPLEMENT

Hughes Aircraft Company, Electronic Properties Information Center. November 1971. 55 pages.

AD–734 598

The bibliography is comprised of annotated references to 268 articles on the electronic, optical, thermal, and mechanical properties of gallium arsenide. Most of the articles were published in the journal literature in 1970 and 1971.

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PROCEEDINGS OF THE 9TH RARE EARTH RESEARCH CONFERENCE. VOLUME I

Virginia Polytechnic Institute and State University. P. E. Field. October 1971. 423 pages.

CONF–711001 (Vol. I)

PROCEEDINGS OF THE 9TH RARE EARTH RESEARCH CONFERENCE. VOLUME II

Virginia Polytechnic Institute and State University. P.E. Field. October 1971. 409 pages.

CONF–711001 (Vol. II)

The Ninth Rare Earth Conference, which was held 10-14 October at Blacksburg, Virginia, included research papers and discussions on the latest developments in the field of the rare earth elements, including the actinides and other related elements. These volumes present the approximately 90 papers, some in abstract form, which were presented at the conference. Volume I contains papers on chemistry, solid state (preparation and properties, magnetics), Mossbauer spectroscopy, biochemistry, and metallurgy, Volume II contains papers on solid state (general, spectroscopy), biochemistry, chemistry, and metallurgy.

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RADIOCHEMISTRY OF MANGANESE. REVISED EDITION

National Academy of Sciences—National Research Council, Subcommittee on Radiochemistry. R. P. Schuman. July 1971. 67 pages.

NAS–NS–3018 (Rev.)

This monograph represents a compilation of available information on the general radiochemistry, radiochemical procedures, and radiochemical techniques involving manganese and its compounds. It is intended for both radiochemists and research workers in other fields who may wish to use radiochemical techniques to solve specific problems. The topics covered include: Radioactive nuclides of manganese; review of the chemistry of manganese; hazards and precautions; counting techniques; separation procedures.

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RADIOCHEMISTRY OF MERCURY. REVISED EDITION

National Academy of Sciences—National Research Council. Josef Roesmer. September 1970. 202 pages.

NAS–NS–3026 (Rev.)

This monograph represents a compilation of information on the general radiochemistry, radiochemical procedures, and radiochemical techniques involving the element mercury and its compounds. It is intended for both radiochemists and research workers in other fields who may wish to use radiochemical techniques to solve specific problems. The topics covered include: Isotopes of mercury; review of features of mercury chemistry of chief interest to radiochemists; nuclear methods of mercury analysis; dissolution methods; collection of detailed radiochemical procedures for mercury.

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RADIOCHEMISTRY OF TITANIUM, REVISED EDITION

National Academy of Sciences—National Research Council, Subcommittee on Radiochemistry. Vincent J. Landis, and James H. Kaye. January 1971. 99 pages.

NAS–NS–3034 (Rev.)

This monograph is a compilation of available information on the general radiochemistry, radiochemical procedures, and radiochemical techniques pertaining to titanium and its compounds. It is intended for use both by radiochemists and by research workers in other fields who may wish to use radiochemical techniques to solve specific problems. Specific topics covered include: Inorganic chemistry of titanium; hazards and precautions in handling titanium-containing materials; counting techniques; and a compilation of radiochemical separation procedures.

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HELIUM: BIBLIOGRAPHY OF TECHNICAL AND SCIENTIFIC LITERATURE, 1965. INCLUDING PAPERS ON ALPHA-PARTICLES

Bureau of Mines, Division of Helium. Philip C. Tully, Emily Dowdy, and Betty G. Noe. November 1971. 760 pages.

PB–205 400

The bibliography contains 3,990 different citations to technical and scientific literature about helium and alpha-particles, abstracted by 12 abstract service publications during 1965.

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SILICATE REACTIONS—A REVIEW

Bureau of Mines. A. G. Collins, and Lillie R. Fisher. 1969. 99 pages.

PB–206 316

Reactions of silica and silicate minerals are of interest to investigators of several scientific disciplines. Knowledge of the solubilities of silicates in saline and nonsaline aqueous media is vital in designing certain types of saline water desalination plants because silicate compounds can cause deleterious reactions in boilers (scale). In order to correctly treat boiler feedwater to prevent scale, knowledge of silicate reactions is necessary. However, some silicate compounds inhibit corrosion of metals in boilers and pipes by forming a siliceous film on the metal surface by adsorption. Why silicates precipitate in one aqueous environment and dissolve in another aqueous environment is a basic chemical geological question. In one environment kaolinite might form, while in another environment serpentine might form. Why and how a clay mineral such as kaolinite alters in a certain aqueous environment is of interest to scientists concerned with water recovery, oil recovery, and recovery of other minerals. Thus because of the importance of silicate reactions, the review was undertaken in order to bring together, in the form of short discussions and annotated bibliographies, the following subjects related to silicate reactions: Methods of analyzing silicates, buffering in aqueous solutions, diagenesis and weathering, hydrothermal reactions in nonsaline and saline aqueous media, and corrosion prevention. An author index is included.

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FUSED SALTS: A BIBLIOGRAPHY. VOLUME I. ACCESSION LIST

Sandia Laboratories (AEC). Michael Schalit. July 1971. 518 pages.

SC–R–71–3315 (Vol. 1)

FUSED SALTS: A BIBLIOGRAPHY. VOLUME II. SUBJECT/PERMUTED TITLE LIST

Sandia Laboratories (AEC). Michael Schalit. July 1971. 654 pages.

SC–R–71–3315 (Vol. 2)

FUSED SALTS: A BIBLIOGRAPHY. VOLUME III. AUTHORS LIST

Sandia Laboratories (AEC). Michael Schalit. July 1971. 274 pages.

SC–R–71–3315 (Vol. 3)

This report provides a comprehensive bibliography of the literature on fused salts. Volume I gives the author, title, source publication, and subject headings (including the compounds dealt with) for all articles and other publications. Subject matter access to this volume is provided through Volume II, and Volume III contains an author index.

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Process Engineering

COMPUTER EVALUATION OF STOCHASTIC AND DETERMINISTIC CONTROLLER DESIGNS FOR A CHEMICAL REACTOR

Louisiana State University, Department of Chemical Engineering. Edgar C. Tacker, Thomas D. Linton, and Armando B. Corripio. February 1971. 21 pages.

AD–732 928

The purpose of this paper is to promote the application of modern control and estimation theory to process control problems. For the sake of simplicity, attention is restricted to the more elementary notions in modern system theory. The control of a typical backmix reactor is chosen as an example. The use of a modern control formulation is compared with more conventional control algorithms of widespread industrial use. The conventional controllers are easily shown to be significantly inferior to controllers designed using modern techniques.

RESEARCH AND DEVELOPMENT STUDIES INTO THE BASIC TECHNOLOGY OF RADIATION INDUCED EMULSION POLYMERIZATION INCLUDING SMALL SCALE PILOT PLANT SYSTEMS

North Carolina State University, Department of Chemical Engineering, V. Stannett, and E. P. Stahel. September 1971. 150 pages.
ORO–3687–1

Emulsion polymerization systems are in principle ideal candidates for radiation initiation. The high yield of free radicals from the radiolysis of water coupled with the long kinetic chains normally associated with emulsion polymerization should ensure high G values for the conversion of monomer to polymer. The report describes some laboratory and engineering studies of some emulsion systems that point up these advantages of radiation induced polymerization and reveal the special features connected with radiation not previously realized. The systems chosen for laboratory studies were butadiene and its co-polymers with styrene and acrylonitrile including a study of acrylonitrile itself and vinyl chloride in emulsion and under precipitating conditions. The rates of reaction and process variables are reported and applied to the design of a small scale chemical reactor.

ELECTROPHORETIC AND ELECTROCHEMICAL WATER PURIFICATION SYSTEMS

Texas Tech University, Department of Agricultural Engineering. W. M. Lyle, and E. A. Hiler. December 1971. 21 pages.
PB–205 804

Obtaining an adequate supply of pure water in many areas is a pressing problem at present. The population explosion along with man's tendency to pollute his environment will make an adequate supply much harder to obtain in future years. The research dealt with the direct use of electric currents and electric fields to bring about water clarification and purification. Electrophoretic and electrochemical water purification systems were investigated as a means of removing suspended pollutants such as clay, algae, and bacteria. The primary emphasis was focused on small domestic water systems; however, the applications to municipal plants as well as other specialized uses were not discounted. The research showed that water purification by electrochemical means was successful both operationally and economically. As a result of the experimental testing, an example design of a small semi-automated electrochemical water system is offered which incorporates electrochemical flocculation, settling and electrochemical disinfection operations.

NITROGEN REMOVAL FROM WASTEWATERS

Federal Water Quality Administration. May 1970. 24 pages.

PB-206 306

Nitrogenous materials in waters have long been associated with pollution. Yet the pollutional potential of ammonia in a stream or lake is often overlooked. Conventional wastewater treatment plants are not efficient in removing nitrogen. The principles and advantages of converting organic nitrogen and ammonia to nitrates to be removed by denitrification need to be understood. Nitrates can be dangerous because they can be converted to nitrites which, in infants, can cause death by methemoglobinemia. The various forms in which nitrogen occurs in wastewater, and the equally varied methods used to remove these nitrogen compounds are the subject of the report. Seven papers provide first a brief review of some possible deleterious effects of nitrogen in a nation's wastewaters in the form of nitrites, nitrates, ammonia, ammonium ion, or dissolved nitrogen gas. Methods of removal which are presented include: (1) suspended growth biological reactors; (2) packed column biological reactors; (3) removal of ammonia nitrogen by air stripping; (4) removal of ammonia nitrogen by ion exchange; (5) removal of nitrates by ion exchange; and (6) miscellaneous other methods for removing various nitrogenous compounds.

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Waste Processing and Materials Recovery

ECONOMICS OF RECYCLING METALS AND MINERALS FROM URBAN REFUSE

Bureau of Mines. P. M. Sullivan, and M. H. Stanczyk. April 1971. 22 pages.

PB-200 052

COST EVALUATION OF A METAL AND MINERAL RECOVERY PROCESS FOR TREATING MUNICIPAL INCINERATOR RESIDUES

Bureau of Mines. J. J. Henn, and F. A. Peters. 1971. 47 pages.

PB-206 627

Every day large quantities of metal and mineral values are discarded in the form of municipal incinerator residues. These residues contain iron, nonferrous metals, and glass which can be recovered and recycled. The Bureau of Mines has developed and demonstrated a technically feasible method for processing incinerator residues on a continuous basis to reclaim the contained metal and mineral values. The flowsheet is straightforward and utilizes conventional and proven mineral engineering equipment. The entire process comprises simply a series of shredding, screening, grinding, and magnetic separation procedures. Products include ferrous metal fractions, aluminum and copper-zinc scrap, colorless glass cullet, and a colored glass fraction. PB-200 052 describes the operation of a 1,000 lb/hr pilot plant and discusses some of the economic aspects of the process.

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WASTEWATER TREATMENT TECHNOLOGY

State of Illinois, Institute for Environmental Quality. J. W. Patterson, and R. A. Minear. August 1971. 281 pages.

PB–204 521

A state-of-the-art review is provided of the literature pertaining to industrial waste treatment. It covers 22 substances frequently found in industrial wastes: Arsenic, barium, boron, cadmium, hexavalent chromium, trivalent chromium, copper, cyanide, fluorides, soluble iron, total iron, lead, manganese, nickel, oily wastes, pH control, phenols, selenium, silver, total dissolved solids, chloride, and zinc. Pertinent information is presented on existing methods of treatment, levels of treatment attainable, and costs associated with those methods and levels of treatment.

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CONVERSION OF CRANKCASE WASTE OIL INTO USEFUL PRODUCTS

National Oil Recovery Corporation. Solfred Maizus, and Kenneth Urquhart. March 1971. 87 pages.

PB–205 207

The research described was undertaken to demonstrate a simplified technique for recycling crankcase waste oil into useful petroleum products without causing pollution. All of the petroleum products from vacuum distillation of the waste oils were sold as low sulfur heating fuel and as potential diesel fuels. Only the water in the fuel was not recovered. Varying composition of the waste oils accounted for much of the operation difficulty encountered. Use of metal based additives is gaining in popularity, and these additives plus their decomposition products caused numerous clogging problems in the equipment. A detailed operating manual presenting start-up, shut-down and emergency procedures is included in the appendices of this publication.

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PETROCHEMICAL EFFLUENTS TREATMENT PRACTICES

Engineering-Science, Incorporated. Ernest F. Gloyna, and Davis L. Ford. February 1970. 292 pages.

PB–205 824

Most of the pollutional load from petrochemical industries emanates from process waste streams. The processes for reducing is potential harm to the environment are well developed and understood. In order to describe the types of processes as they relate to the industry as a whole, the report reviews the following aspects of the petrochemical industry: History; petroleum raw materials; petrochemical processes; chemical and process related classification of wastes; water pollution effects; waste treatment methods; water reuse; and economic aspects of waste treatment.

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DEVELOPMENT OF IMPROVED CUTTING TOOL MATERIALS

Carborundum Company. E. Dow Whitney, Yorihiro Murata, H. Paul Julien, John E. Niesse, and Philip H. Crayton. October 1965. 462 pages.

AD-473 942

The greatly reduced machinability of super alloys and refractory metals has imposed severe limitations on the fabrication of these materials. Very often the machining rates of these metals are 1/10 to 1/20 those for conventional low alloy steels. New and improved ceramic cutting tools for the machining super alloys and refractory metals have now been developed, as described in this report. It has been demonstrated that the new tools show a substantial improvement over commercially available tools in the machining of the above metals. The best of the new tool materials proved to be hot pressed 60 wt. % TaN—40 wt. % ZrB_2. Other ceramic systems which exhibited definite promise were 50 wt. % TaN—50 wt. % TiB_2, and 50 wt. % TiB_2—50 wt. % TaC. The document covers the selection of the materials, the development of fabrication techniques for the materials, and the evaluation of their cutting performance.

CHEMICAL STRENGTHENING OF CERAMIC MATERIALS

Ceramic Finishing Company. Henry P. Kirchner, Robert M. Gruver, and Dennis R. Platts. December 1971. 107 pages.

AD-735 135

In polycrystalline ceramics subjected to external forces fracture originates at surface flaws. The strength of ceramics may be increased by providing compressive surface layers which raise the nominal stress at which the surface flaws act to cause failure. In this investigation, treatments to form compressive surface layers were applied to alumina, steatite, zircon porcelain, silicon nitride and silicon carbide bodies. The methods used included quenching, glazing and quenching, and formation of low expansion surface layers by chemical reaction with powders and by chemical vapor deposition at high temperatures. Substantial improvements in impact resistance, elevated temperature flexural strength and resistance to penetration of surface damage were demonstrated. A wide variety of specimen shapes and sizes was strengthened. In some cases the compressive surface layers were so effective that the fracture origins were shifted from surface flaws to internal flaws. Other processes that yielded improvements in strength were quenching of steatite, low expansion surface layers of silicon nitride formed by chemical vapor deposition on zircon porcelain and hot pressed silicon carbide, and impregnation of reaction sintered silicon nitride.

PROCESSING OF CERAMICS—SURFACE FINISHING STUDIES

Stanford Research Institute. Rudolf Sedlacek. November 1968. 59 pages.

AD–846 284

In recent years, oxide ceramics having certain favorable mechanical and physical properties have been gaining wider acceptance in various applications for which they are particularly well suited. Because of the hardness of ceramics, the number of machining methods is limited, and grinding with bonded diamond constitutes the most widely used industrial method of material removal. This document describes the results of an investigation of the effect of various parameters of the grinding process on the tensile strength of alumina. In particular, the detrimental effect of water on the strength of alumina is shown. Consideration is also given to the relationship of attainable surface finish and microstructure characteristics of polycrystalline ceramics.

Composite Materials

COMPOSITE MATERIALS

North Atlantic Treaty Organization. September 1971. 238 pages.

AD–732 741

The document is comprised of 21 papers presented at a symposium held at the Ecole Nationale Superieure de l'Aeronautique, Paris, 2-3 April 1970. The papers deal with both original studies and state-of-the-art reviews of various composite materials systems. The subject matter covers elastic constants related to composite materials, testing methods, interface problems, development of metallic matrix composites, and computation methods. Slightly more than half of the papers are in English, the remainder are in French.

SURVEY OF THE LITERATURE ON STRENGTH CHARACTERIZATION OF FIBER REINFORCED COMPOSITE MATERIALS

Southwest Research Institute. P. H. Francis, and W. L. Ko. November 1970. 62 pages.

AD–733 747

Research and development work in the mechanics of materials has been profoundly influenced by the advent of fiber reinforced composites. The high anisotropy inherent in these materials makes them very attractive as structural elements because, unlike the case with isotropic materials, the material can be designed so that its preferred directions are compatible with the loading directions of the structure. For this and other reasons, structural efficiencies are potentially much higher with fiber reinforced composites than with single-phase isotropic materials. This report was issued to document the state of knowledge as regards two aspects of composite material behavior: Composite material characterization, which is reviewed within the context of linear and nonlinear viscoelastic theory; and failure phenomena, which is discussed within the context of continuum theories and statistical theories. A bibliography of over 200 references is included.

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BORON IN COMPOSITE MATERIALS

Defense Documentation Center. April 1971. 87 pages.

AD–733 870

The references in this bibliography of U.S. Government-funded reports deal with the use of boron and boron fibers in prolonging the life and reinforcing the structure of composite materials. The resistivity, elasticity, and thermal properties of these composites are discussed. There is also a cross section of references on manufacturing methods and test procedures. Among the topics covered are single crystals and whiskers, exotic materials; crack, fracture, and high pressure mechanics; wing and air frame structures; reinforced plastics; rods, textiles, and gaskets. An abstract accompanies each entry in the bibliography, and all reports cited are available from NTIS.

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PRELIMINARY SURVEY OF POLYMER-IMPREGNATED STONE

Brookhaven National Laboratory, Associated Universities Incorporated. Meyer Steinberg, and Peter Colombo. September 1970. 52 pages.

BNL–50255

It has been recognized that techniques of impregnation with a polymer might be applied to improving the strength properties of rock in order to effect chemical stabilization of underground structures and supports. The report discusses a series of tests involving impregnation with several different monomers. A relatively weak porous volcanic tuff and a relatively strong, dense sandstone were impregnated with the following monomers: methyl methacrylate, chlorostyrene, polyester and styrene, TMPTMA-styrene, and TMPTMA-chlorostyrene. In situ polymerization was accomplished by both radiation and chemical initiation techniques. Significant improvement in the strength properties of the stone resulted.

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AN INVESTIGATION OF CERTAIN PHYSICAL AND MECHANICAL PROPERTIES OF WOOD-PLASTIC COMBINATIONS

Research Triangle Institute, and North Carolina State University. Eric Ellwood, Robert Gilmore, James A. Merrill, and W. Kenneth Poole. May 1969. 159 pages.

ORO–638

PREPARATION OF WOOD-PLASTIC COMBINATIONS USING GAMMA RADIATION TO INDUCE POLYMERIZATION

West Virginia University. William R. Boyle, Anthony Winston, and Wesley E. Loos. May 1971. 249 pages.

ORO–2945–10

Many of the physical and mechanical properties of wood may be appreciably improved by impregnating the wood with monomers and then polymerizing the monomers using gamma irradiation. Some of the properties showing the greatest improvement are side hardness (up to 11-fold increase), abrasion resistance (up to 7-fold increase), compression perpendicular to the grain (up to 6-fold increase), and antiswell efficiency (up to 60-70%, where 100% would indicate no swelling). ORO-2945-10 deals with the chemistry of polymerization in wood, the technology of wood-plastic combination manufacture, and some of the properties of wood-plastic combinations. The polymer portions of the combinations studied were formed from methyl methacrylate, vinyl acetate, a comonomer of styrene and acrylonitrile, vinyl chloride, various acrylate monomers, styrenes, and other comonomer systems. ORO-638 provides the results of an evaluation of the physical and mechanical properties of combinations of four species of wood with four monomer systems (methyl methacrylate, methyl methacrylate plus phosgard, styrene plus acrylonitrile, and ethyl acrylate plus acrylonitrile).

Construction Materials

DEVELOPMENT OF AN IMPROVED DUST-CONTROL SYSTEM BASED ON POLYVINYL ACETATE LATEX

Union Carbide Corporation. D. F. Anderson, J. A. Durante, and L. H. Wartman. October 1971. 46 pages.

AD–732 484

Dust control is a problem inherent in many areas such as farming, construction and land reclamation. Not only is dust control important in abating topsoil erosion, it is also important in protecting damage to construction machinery, in maintaining visibility under windy conditions, and in preventing water pollution. An effective dust control material is DCA–70, a polyvinyl acetate latex with dibutyl phthalate as a plasticizer. However, dibutyl phthalate is quite volatile and evaporates quickly in hot climates. Since many commercial plasticizers of much lower volatility than dibutyl phthalate are available, a program was undertaken to find a plasticizer system which could be substituted for the dibutyl phthalate to yield a product with better aging characteristics. Presented are the results of the study and the plasticizer formulations providing an improved system.

TEMPERATURE-INDUCED DIMENSIONAL CHANGES IN HARDENED CONCRETE

Army Engineer Waterways Experiment Station. Helmuth G. Geymayer. June 1969. 48 pages.

AD–733 744

The increasing use of concrete in structures such as nuclear reactor containment vessels, desalination plants, liquefied gas containers, etc., which, because of their uses, are subject to environmental thermal stresses of unusual intensity of duration or both, and the occasional difficulties with temperature-induced dimensional changes in more conventional concrete structures have caused renewed interest in the thermal expansivity of concrete and the factors affecting it. A critical review was therefore made of available information on the subject and some thoughts are presented concerning the treatment of temperature-induced dimensional changes in concrete elements. Following a discussion of the phenomena induced by temperature changes in concrete, coefficients of thermal expansion reported in the literature for various concretes and test conditions are reviewed and an incremental iteration analysis is outlined as a possible approach to solve complex thermal expansion problems.

METHOD OF TEST FOR CONCRETE DILATION

U.S. Army Engineer Waterways Experiment Station. D. L. Ainsworth, and A. M. Alexander. November 1969. 45 pages.

AD–733 745

A system has been developed to study the effects of the physical environment on concrete. This system is designed to continuously measure the total length change in a concrete specimen due to wetting and drying, temperature change, and freezing and thawing. Dilation is the increase in length of concrete as it is cooled into the freezing range of contained water. Dilation in a specimen exceeding 50 microinches per inch is considered critical and may damage the specimen. The system, therefore, was designed to have a sensitivity of at least 10 microinches. Numerous dilation tests were conducted on moist specimens to determine the magnitude of dilation and to proof test the system. These data are included in this report.

EVALUATION OF FOAMED PLASTICS FOR USE AS STRUCTURAL SUPPORTING LAYERS IN PAVEMENTS AND FOUNDATIONS

U.S. Army Engineer Waterways Experiment Station. A. H. Joseph, R. D. Jackson, and T. B. Rosser, III. November 1971. 84 pages.

AD-733 874

In areas of such low soil strength that the soil will not support conventional construction, suitable local materials for foundations or platforms may not be available and other construction techniques must be employed. It has now been found that foamed plastics, particularly polystyrene and polyurethane, can be used as a structural layer in areas of low soil strength, or when conventional methods of construction are too difficult or too expensive to be considered. Using the proper design and construction procedure, foamed plastics are suitable for use in support of rolling and static loads in swamps, deltas, and other situations of very low-strength soils.

DEVELOPMENT OF A CHEMICAL COATING FOR AIRFIELD RUNWAY MARKING

U.S. Army Mobility Equipment Research and Development Center. Harvey Miller, and Stanley P. Dowdy. September 1971. 84 pages.

AD-734 320

Airport runway marking systems must be able to withstand not only wear but also cleaning compounds used in cleaning the markings. The report describes laboratory and field tests conducted to develop serviceable airport marking systems that will be superior to the systems presently available and also to develop a satisfactory cleaner to remove burned rubber and other runway dirt without affecting the service properties of the runway striping coating, thus increasing the effective life of the coating and extending the time between recoatings. A study of highway and airfield runway coatings was conducted to determine which might be effective as runway markings. These included paints, reflective beads, and a coating called "Liquid Stone." After testing various formulations, several systems were found which hold promise as having the desired characteristics as runway markings and cleaners. In one case, a new polymeric coating was prepared from a linear bisphenol polyether. Also, a ketonic-alcoholic-aromatic hydrocarbon solvent was found very effective as a cleaner.

MAINTENANCE AND REPAIR OF CONCRETE AND MASONRY STRUCTURES: EPOXY PRESSURE GROUTING

The University of Arizona, Engineering Research Laboratories. J. D. Fuller, and J. D. Kriegh. July 1971. 63 pages.

AD-734 930

Epoxy pressure grouting is an easy and economical method to repair cracks in masonry and concretes. The reasons for these repairs may include the restoration of structural integrity, waterproofing, or even aesthetics. This report reviews existing pressure grouting methods, and evaluates available methods and materials.

ASPHALTIC CONCRETE CANAL LINING AND DAM FACING

Bureau of Reclamation. September 1971. 38 pages.

PB-204 992

As early as 1946, hot-mix asphaltic concrete was included in research and development studies to investigate use of asphalt in hydraulic construction on Bureau of Reclamation projects. Asphalt is an extremely versatile material and the key to its successful use lies primarily in the selection of the proper type of materials and methods of construction. It was the objective of the laboratory and subsequent field investigations to determine the best materials and methods for construction of asphaltic concrete linings and dam or dike facings with emphasis on low cost. Hot-mix asphaltic concrete is a controlled mixture of asphalt cement and graded aggregates mixed and placed under elevated temperature. For hydraulic construction application it is necessary that the asphaltic concrete be essentially a voidless mix to insure impermeability. Therefore hydraulic mixes are designed with dense graded aggregates and high mineral filler and asphalt cement contents. This report gives a description of various Bureau-constructed asphaltic concrete installations with discussions on performance evaluation and maintenance. Also, laboratory data associated with some of the installations are presented.

AN ANNOTATED BIBLIOGRAPHY ON USE OF RUBBER IN ASPHALT PAVEMENTS

Materials Research and Development, Incorporated. F. S. Rostler. May 1971. 110 pages.

PB-206 965

Considerable effort has gone into research studies and experimental construction to demonstrate the advantages of using rubber in highway asphalts. In almost every case laboratory tests indicate that significant improvements might be expected from the use of rubber. This report provides a systematic review of the published literature primarily for the purpose of assessing the state-of-the-art and the conditions under which rubber might be economically used. An appendix presents an overall evaluation of the theory and practice of the use of rubber in asphalt pavements.

EVALUATION OF NEW AND IMPROVED FORGING LUBRICANTS

TRW Incorporated, Materials Technology Laboratory. Earl H. Roland. October 1968. 181 pages.

AD–844 152

Forging lubricants are usually chosen for a particular forging process or evolved by trial and error procedures using production equipment during actual production runs. An effort has now been made to place the evaluation of these lubricants on a more scientific basis. A series of laboratory bench tests were evolved which permit the evaluation of those lubricant parameters which are important in the forging process. These tests were then used to screen potential forging lubricants. The best lubricant system established through the bench tests was evaluated by actual closed die forging of a typical structural shape from a titanium alloy and a nickel alloy on four classes of forging equipment currently in use in the forging industry (hammer, hydraulic, mechanical, and high energy rate forming). A large number of lubricants were classified and rated on the basis of the bench tests and forging evaluations.

APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY, A TECHNOLOGY TRANSFER PROFILE: LUBRICATION

Denver Research Institute, University of Denver. James P. Kottenstette, James E. Freeman, Conrad R. Heins, William M. Hildred, F. Douglas Johnson, and Eileen R. Staskin. July 1971. 87 pages.

N72–12417

The common denominator to all industrial lubrication is extending the life of a mechanical system. In spite of continued research and constant advances in the field of lubricants, much of the energy produced by mechanisms is still lost through friction. Thus interest is universal in preserving the performance and life of moving parts. The document reviews the history and progress of lubrication, beginning with animal fats, continuing through petroleum oils, and extending to synthetics; progress from Babbitt metal and graphite to fluorides is noted; and new processes such as the sputtering of dry films or the ion plating of gold are cited. Methodology and trends are discussed under the classifications of liquids such as oils and greases, gases for gas bearings, and many varieties of solids. A detailed discussion is included of the transfer of new technologies developed for aerospace applications to industrial usage in other fields. A number of new lubricants and methods are listed.

DESIGN MECHANICAL PROPERTIES FOR TRIP STEEL

Stanford Research Institute. D. Weinstein. December 1969. 57 pages.

AD–864 181

TRIP steels are a class of thermomechanically treated high-alloy steels that combine high ductility with high strength. They were first described in 1967. A typical composition is Fe-9Cr-9Ni-4Mo-2Mn-2Si-0.25C. This document provides the results of a study of selected mechanical properties of TRIP steels. It is evident from the data acquired that TRIP steels represent a significant development in ferrous alloys. The levels of strength that can be achieved, combined with highly acceptable values of tensile elongation and very high degrees of toughness are essentially unsurpassed by ausformed or maraged steels. Fatigue properties are comparable with those of the more common high-strength steels, and certain TRIP steel compositions have been developed that show evidence of possessing aqueous corrosion resistance nearly equivalent to certain 18-8 stainless steels.

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A NEW METHOD FOR THE DETERMINATION OF MATERIAL FLOW STRESS VALUES UNDER METALWORKING CONDITIONS

Westinghouse Electric Corporation. George Saul, Alan T. Male, and Vincent Depierre. March 1970. 109 pages.

AD–869 171

For the adequate mathematical understanding of metalworking processes and the theoretical prediction of deformation loads, there is a precise need for accurate knowledge of the basic flow stress behavior of the workpiece material under particular conditions of temperature and strain rate. A new technique is described in this report for the generation of true stress-strain data for metallic materials undergoing bulk plastic deformation. This technique involves the use of flat ring-shaped specimens which have a "built-in" ability to measure interface friction. Measurement of the ring shape change under a known deformation load provides the basis for obtaining the required data. Flow stress values so obtained are in good agreement with data from the same materials using the very tedious Polakowski technique. There is every indication that the ring technique can be applied to determine accurate data under deformation conditions of high temperatures and high strain rates typical of many industrial metalworking operations.

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MECHANICAL PROPERTIES OF SHOCK-STRENGTHENED AUSTENITIC STAINLESS STEEL

Battelle Columbus Laboratories. M. Kangilaski, and A. A. Bauer. June 1971. 40 pages.

BMI–1909

It has been known for some time that when a shock wave is passed through a metal, mechanical properties of the metal will change. The study reported in this document was aimed at defining the influence of shocking parameters on mechanical property and structural changes in types 304 and 316 stainless steels. Shocking, by means of either a flyer plate or contact explosives, was found to significantly increase the yield strength and proportional limit, moderately increase the ultimate strength, and generally decrease the ductility. Effects of variations in shocking pressure, shocking temperature, method of applying shocking pressure, and post-shock heat treatments are described for these and other properties.

METALLURGY: A COMPILATION

National Aeronautics and Space Administration. 1970. 31 pages.

N71–34471

A number of innovations in the field of metallurgy and in the metals industries developed by or for NASA have potential applications outside of the aerospace industry. The document presents brief summaries on methods of testing and detection, properties and descriptions of metals, and improvements in processing. A form for requesting additional technical information on individual devices and techniques is included.

DISPERSION STRENGTHENING OF LEAD BY COPRECIPITATION

Bureau of Mines, Rolla Metallurgy Research Center. M. M. Tilman, R. L. Crosby, and D. H. Desy. 1971. 14 pages.

PB–205 497

The excellent corrosion resistance of lead and its sound attenuation capability, easy formability, and other advantageous properties have not been fully utilized in many applications owing to its poor creep resistance and low strength. Improvement of these properties would permit the use of lead in areas where scarcer, more expensive, materials are now used and would broaden the areas of potential application of lead. It has now been found possible to prepare relatively high-strength, creep-resistant lead utilizing the coprecipitation method of dispersion strengthening. The method involves the simultaneous precipitation of lead carbonate and aluminum hydroxide followed by roasting to oxides and hydrogen reduction of the lead oxide. The resulting powder is processed by powder metallurgy methods.

THE PREVENTION OF SURFACE ELECTRICAL LEAKAGE IN THE PRESENCE OF MOISTURE

Naval Research Laboratory, Surface Chemistry Branch. Hayward R. Baker, and Robert N. Bolster. October 1971. 24 pages.

AD–732 378

The electrical leakage of insulation exposed to moisture, particularly when salt deposits from a marine environment are also present, can degrade the performance of electrical and electronic equipment or render it inoperative until cleaned and dried. Studies have been made on the effects of prolonged bulk moisture condensation on the surface electrical resistivities of some typical insulating materials and coatings. As in the case of exposure to relative humidities below saturation, the materials of low surface energy maintained higher resistivities. Nonporous coatings with low surface energies maintained high resistivities even when applied to the poorer substrates, but porous coatings showed continual declines. The water-displacing abilities and the protection provided by several agents were evaluated, and a superior formulation was developed. This formulation rapidly displaced moisture to restore insulation resistivity, and dried to a solid film which maintained high resistivity upon reexposure to moisture. The report describes the preparation and properties of the new coating.

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PBI TOW MANUFACTURING METHODS

Celanese Research Company. Arthur E. Prince. August 1971. 146 pages.

AD–733 727

Polybenzimidazoles (PBI's) are a relatively new group of high molecular weight polymers with excellent strength and stability properties. This report describes a project intended to (1) scale-up the single stage PBI polymerization process; (2) increase spinning productivity; (3) establish a tow process for processing large bundles of yarn in a continuous manner; (4) produce 500 lbs. of quality product; and (5) revise the economics of a 1 MM lb/yr production plant. All of the above objectives were successfully achieved. Improved processes leading to PBI staple fiber were established, and improved economics resulted from process improvements and higher production in all areas.

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MACHINE COOLANT SELECTION AND MAINTENANCE MANUAL

Bendix Corporation, Kansas City Division. V. A. Lyons. November 1970. 83 pages.

BDX–613–205 (Rev.)

To select the fluid best suited to each machining operation requires an understanding of the basic functions of coolants and cutting compounds. This manual provides the rudiments of such knowledge by briefly discussing the principles of fluid selection and describing applicable procedures. The following information is included in this manual: Procedures for establishing coolant bulk numbers and determining stock quantities; methods of storage, control, and distribution; charts and tables for selecting coolants and their appropriate concentrations; instructions for mixing and replenishing cooling emulsions; and instructions for cleaning machine sump systems.

MINERALS YEARBOOK 1969. VOLUME IV. AREA REPORTS: INTERNATIONAL

Bureau of Mines. 1971. 942 pages.

PB-206 669

This yearbook provides a record of performance of the world's minerals industry during 1969. Volume IV presents the latest available mineral statistics for more than 130 countries and areas (excluding the United States) and discusses the importance of minerals to the economies of these nations. Also included is a review of minerals in the world economy.

A RING SHEAR TEST FOR QUANTITATIVELY MEASURING ADHESION OF METAL DEPOSITS

Sandia Laboratories (AEC). J. W. Dini, J. R. Helms, and H. R. Johnson. May 1971. 32 pages.

SCL-DR-710040

Ring shear tests for measuring adhesion of metal deposits have been developed. The tests may be used to determine the optimum conditions for preparing various substrates for plating with a variety of metals. This report describes specimen design, die design, and the testing technique; and it shows that quantitative, reproducible adhesion data can be obtained by the method.

Plastics and Elastomers

INVESTIGATION OF METHODS FOR IMPROVING THE FRICTIONAL PROPERTIES OF RUBBER COMPOUNDS USED IN FOOTWEAR

U.S. Army Natick Laboratories. Patrick J. Mahoney. July 1971. 30 pages.

AD-733 312

In designing footwear, it is desirable to maximize the friction between the sole and a dry or wet surface. Previous work has shown that no specific type of rubber provides inherent superior frictional properties over others. Efforts to improve frictional qualities entailed the testing of various tread designs, additive materials such as cork and cotton flock, composite specimens, and channeled and siped specimens. The data obtained should be of value in the design of rubber soles.

TORSIONAL BRAID ANALYSIS. A SEMIMICRO THERMOMECHANICAL APPROACH TO POLYMER CHARACTERIZATION

Princeton University, Polymer Materials Program. John K. Gillham. November 1971. 200 pages.

AD–734 005

Torsional braid analysis (TBA) of polymeric materials is reviewed. This is an easy and yet sophisticated method for obtaining and understanding the mechanical behavior of bulk polymers. A multifilament inert (glass) braid is impregnated with polymer to form a specimen which is subjected to a series of freely damped torsional oscillations in a torsional pendulum experiment. This unique approach of *chemistry on a string* permits the *in situ* investigation of the effect of reactive and physical processes on the mechanical properties of polymers and thereby bridges a traditional gap between synthetic and physical polymer science. The present status of the concept, the instrumentation, the technique of application, and application to selected pragmatic, novel and theoretically interesting polymers are highlighted.

ETHYLENE-PROPYLENE RUBBERS AS ANTIOZONANTS

U.S. Army Weapons Command, Science and Technology Laboratory. Z. T. Ossefort, and E. W. Bergstrom. August 1968. 39 pages.

AD–734 322

An antiozonant may be described as a substance which, when mixed into uncured rubber, will prevent or delay the appearance of cracking in stressed vulcanizates prepared therefrom when they are exposed to air-ozone mixtures. The most effective antiozonants in use are the substituted p-phenylene diamines originally described in 1954. However, many inherent limitations exist regarding the performance and use of these substances. It is now shown that ethylene-propylene terpolymer elastomers have wide usefulness as antiozonants for diene elastomers. The extent of usefulness of these elastomers and their limitations for this purpose are described. It is indicated that in many cases these polymeric antiozonants may be used where chemical antiozonants function only poorly or not at all.

WORLD INDEX OF PLASTICS STANDARDS

National Bureau of Standards, Institute for Applied Technology. Leslie H. Breden. December 1971. 458 pages.

COM–72–50003

This computer-produced Index contains the printed titles of more than 9,000 national and international standards on plastics and related materials which were in effect as of December 31, 1970. These standards are published by technical societies, trade associations, government agencies, and military organizations. The index is arranged so that each standard may be found under any significant word in its title. Each entry includes the date of publication, the standard number, and the issuing organization.

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APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY, A TECHNOLOGY TRANSFER PROFILE: PLASTICS

Denver Research Institute, University of Denver. James P. Kottenstette, James E. Freeman, Conrad R. Heins, William M. Hildred, F. Douglas Johnson, and Eileen R. Staskin. July 1971. 77 pages.

N72–12515

Interest has arisen recently in determining the impact of space research on polymer investigation and plastic product design. An attempt, for example, to develop ablator binders for atmosphere entry resulted in the discovery of polyimides, a material with high temperature strength and imperviousness to chemicals. A search for rocket chamber ablators led to the discovery of a new class of thermosetting plastics. The report is concerned with the transfer of such new know-how to commerce and industry, attempting to answer the questions of how time affects transfer, and what may hinder or speed the process. Some statistical overviews and forecasts are made, the contribution of information dissemination is assessed, and the stages of transfer are discussed. Included are several chemical representations of polymer syntheses.

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Wood

SIMULATED SERVICE TESTING OF WOOD AND WOOD-BASE FINISH FLOORING

U.S. Department of Agriculture, Forest Products Laboratory. Wayne C. Lewis. 1971. 23 pages.

AD–734 075

Finished wooden floors have never lost their attractiveness to the public for home construction, despite the introduction of other flooring materials whicch have offered lower costs. To satisfy the desire for wood flooring, research is in progress to discover new kinds of this flooring that are lower in initial cost, more adaptable to modern construction methods and lower in cost to install. The document describes test procedures in this direction, discussing assessment methods for both new woods and new wood-bases. These procedures are for measuring resistance to loadings, floor surface indentation from small loads or falling objects, and damage from rolling loads. Methods are presented for measuring abrasion resistance, coefficient of friction, and the effects of surface wetting.

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MECHANICAL, INDUSTRIAL, CIVIL, AND MARINE ENGINEERING

Bonding and Joining

STUDY OF WATER SOLUBLE FLUXES

Radio Corporation of America. May 1966. 50 pages.

AD–821 949

Results are given of a study of water soluble residue fluxes which was undertaken to evaluate this class of solder fluxes with respect to their suitability for various electrical and electronic uses, including printed wiring applications. Both water solvent and mixed solvents were surveyed. Representative commercially available samples were tested for type of active ingredient, efficiency of fluxing, effect on insulation resistance of printed wiring test patterns, and ease of removal from soldered boards. Recommendations for the selection and use of water soluble fluxes are provided.

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METHODOLOGY FOR ANALYSIS OF FATIGUE IN SOLDER JOINTS

Sandia Laboratories (AEC). L. J. Merrell. August 1971. 30 pages.

SC–RR–710326

The document provides criteria by which the capacity of solder-joint designs to withstand cyclic loading can be judged. A "safe" number of cycles, at any strain value (or several values) may be predicted from knowledge of the geometry and properties of the materials in the solder joint and the temperature cycle expected.

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Building Technology

USE OF COMPUTERS FOR ENVIRONMENTAL ENGINEERING RELATED TO BUILDINGS

National Bureau of Standards, Institute for Applied Technology. T. Kusuda. October 1971. 826 pages.

COM–72–50068

In recent years the use of computers has had a rapidly increasing impact on the design, performance analysis, and control of environmental systems related to buildings. This impact is reflected in the 59 papers which comprise this volume. The papers were originally presented at an international symposium which was held at Gaithersburg, Maryland, 30 November-2 December, 1970. They deal with the application of computers to such problems as building heat transfer calculations, heating and cooling calculations, system simulations, energy usage analyses, computer graphics, air and smoke movement inside buildings, and weather data analyses for load and energy usage calculations.

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PROPOSED MINIMUM STANDARDS FOR PERMANENT LOW-COST HOUSING AND FOR THE IMPROVEMENT OF EXISTING SUBSTANDARD AREAS

Department of Housing and Urban Development. May 1966. 106 pages.

PB–179 370

A handbook of minimum standards for low cost housing has been prepared for use in developing countries, particularly in Latin America, based principally on existing codes, ordinances, and standards in the countries of Central and South America and the Caribbean area. These regulations were examined for requirements arising from local conditions, such as social, climatic, or special, and they are intended to aid designers or developers of housing projects. They may serve as a yardstick to measure the acceptability of a housing project which is proposed for outside assistance. Topic heads include neighborhood, plot, and building planning; construction of components and design for geographic location; structural properties and materials; heating systems, plumbing and sanitation; and electrical equipment. Covered also are multifamily housing, fire protection, and mechanical household equipment. Substandard areas of the locality are of particular concern.

COOPERATIVE HOUSING

Department of Housing and Urban Development. J. Robert Dodge. July 1971. 76 pages.

PB–206 514

A housing cooperative is a community owned building complex that is democratically controlled by its residents and is operated for their benefit rather than for investor profits. An individual members investment is his personal and private property. The form that such a cooperative takes will vary in different countries, since it will be organized under the customs, laws, and social and economic conditions of the local scene. The document lists the general types: limited objective, such as only to acquire land and title; mutual ownership, in which the cooperative retains the title but maintains the property on behalf of the members; multiple mortgage, in which the members hold legal title to individual dwellings but all the common property and facilities are owned in common; and tenant, in which a nonprofit cooperative builds dwellings but only leases them with the occupants having a voice in management. Other forms are noted which may appear to be but are not true cooperatives. A discussion is given of the various advantages and disadvantages of housing cooperatives, how they may be organized, sponsored, and managed; financing, construction procedures, and allied topics. Particular reference is made to low income projects in the developing countries, and to education in the principles and practices of cooperative living. Illustrations of styles of buildings which are in use in various countries about the world are included.

A PRELIMINARY INVESTIGATION OF THE POTENTIAL USE OF FOAM PLASTICS FOR HOUSING IN UNDERDEVELOPED AREAS

University of Michigan, Architectural Research Laboratory. S.C.A. Paraskevopoulos, H. J. Borkin, R. M. Darvis, and C. T. Larsen. 1963. 102 pages.

PB–206 799

Experience in the newly developing countries has shown that it is not enough merely to try to increase the local supply of housing through refinements in the use of indigenous materials and the traditional handicraft methods of construction. Besides having intrinsic limitations which seriously restrict both quality and quantity in the output of new dwellings, such refinements contribute little of lasting value to the industrial and economic development of a country. This report describes a study of the feasibility of using plastics, particularly foam plastics, for low-cost housing in developing countries. The advantages of foam plastics are reviewed, as are the important physical properties, present structural applications, and potential uses in housing of the materials. The mechanical properties of foam plastics are discussed from the point of view of structural engineering, production methods, and erection techniques. A number of promising structures are illustrated.

STRUCTURAL POTENTIAL OF FOAM PLASTICS FOR HOUSING IN UNDERDEVELOPED AREAS

University of Michigan, Architectural Research Laboratory. S.C.A. Paraskevopoulos, H. J. Borkin, J. S. Crandall, et al. November 1965. 295 pages.

PB–206 969

A feasibility study, reported in PB–206 799, established the desirability of investigating the use of foam plastics as structural materials, in the belief that such a development could contribute towards a resolution of housing problems throughout the world. This report describes a research program aimed at exploring the structural potential of these materials for housing in underdeveloped areas. A review is provided of plastics from the standpoint of physical properties, raw materials resources, production, and marketing. A detailed description is given of a structural investigation of foam plastics, and a number of demonstration structures are analytically described.

FACTORS GOVERNING THE INTRODUCTION OF FOAM PLASTICS FOR HOUSING USE IN UNDERDEVELOPED AREAS OF THE WORLD

University of Michigan, Architectural Research Laboratory. S. C. A. Paraskevopoulos, et al. June 1966. 64 pages.

PB–206 976

The technical and economic feasibility of using foam plastics in housing in underdeveloped areas of the world has been established, as described in previous reports in this series (see PB–206 799 and PB–206 969 in this issue). This document represents a follow-up intended to advise AID specifically on the introduction of foam plastics for housing use abroad and to report on progress of an on-going testing program. Paper-laminated foam board gives every indication that it is a building material suitable for many different applications, and possible uses of this material in inexpensive roofing systems are described and illustrated.

INDUSTRIALIZED HOUSING

Organization for Social and Technical Innovation. Ian Donald Terner, and John F. C. Turner. January 1972. 79 pages.

PB–206 851

Industrialized housing is a concept of mass production whereby housing is made available to more people by a system of economy, speed, and quality control in which the product is standardized, labor is specialized, methodology is concentrated, and mechanization or automation is employed. Prefabrication is of special value in which a system, aimed particularly toward the demand for housing in the developing countries of Africa, South America, and Asia. The document discusses both negative and positive aspects of exporting housing technology to these lands, citing operating difficulties and problems in several actual construction projects. The attempt is made to establish criteria for assessing such systems and to design new systems appropriate to specific localities, pointing out the hazards of attempting to transfer technology without modification addressed to low income families. A review is made of presently available structures, and indications are given for further development in the field.

NEW COMMUNITIES, ANNOTATED BIBLIOGRAPHY

Decision Sciences Corporation. November 1971. 61 pages.

PB–206 880

NEW COMMUNITIES. SYSTEMS FOR PLANNING AND EVALUATION

Decision Sciences Corporation. November 1971. 397 pages.

PB–206 882

NEW COMMUNITIES. SURVEY OF STATE-OF-THE-ART

Decision Sciences Corporation. November 1971. 180 pages.

PB-206 883

Planners of new communities have a need for techniques for the evaluation of new development concepts. The first of this series of reports (PB-206 880) contains a bibliography of literature available on new communities. A summary is included of each of the references cited. The use of a previously developed system of computer-based models known as the Basic New Community Simulator (NUCOMS) is shown, in PB-206 882, to be feasible for the economic evaluation of new communities. The basic methodology for structuring the evaluation problem is presented. Other topics discussed include: Requirements for evaluating the developer's planning process; the relationships between physical planning and social planning; and the proper role of advanced computer-based techniques relative to conventional analysis. A state-of-the-art survey (PB-206 883) provides a complete review of existing techniques for quantitative urban analysis.

PLANNING SITES AND SERVICES PROGRAMS

Department of Housing and Urban Development. Alfred P. Van Huyck. July 1971. 78 pages.

PB-207 619

Housing sites and services projects are not a new idea, but the adoption of the concept on a massive scale is only just now gaining credibiilty as the most feasible method for dealing with the vast numbers of low-income people seeking land and shelter in the developing world. This document analyzes reasons that sites and services projects should be a major part of the urbanization program of the developing countries. It also discusses the lessons to be learned from previous worldwide experience with the sites and services concept. A method is proposed for planning the sites and services project, and suggestions are given as to how the individual project should be viewed in the context of a national program. It is expected that the sites and services solution will become a useful program of governments which have discovered it is simply not possible to meet the needs of their people through traditional methods of subsidized public housing.

Civil Engineering

TESTS ON CONCRETE SHEET PILES WITH PLASTIC INTERLOCK

Army Engineer Waterways Experiment Station. G. S. Orenstion, and P. A. Calenzo. March 1969. 47 pages.

AD-732 419

Considerable research is being devoted—in a number of engineering fields to finding reliable substitutes for steel. The present investigation involves the structural properties of a polyethylene interlock material for use as a water stopper in concrete sheet piling to replace steel sheet piling. Results are reported of standard tests of strength, elongation, aging, and reactivity with detrimental elements. Most of the data appears in tabular and graphic form.

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COMBINED THERMAL WEAKENING AND MECHANICAL DISINTEGRATION OF HARD ROCK

University of Missouri. George B. Clark, Terry F. Lehnhoff, et al. August 1971. 36 pages.

AD–732 455

Tunneling through hard rock presents special problems of boring, material properties, and economic considerations. Accordingly, considerable work is being conducted in hard rock mechanics, with particular effort in the field of computer analysis. The document reports on investigation of the combined effects of thermal weakening and thermomechanical fragmentation of hard rock, leading toward a better understanding of the processes required for speedier and more economical techniques. Secondary fragmentation or rock crushing processes may also be able to utilize the findings. Theoretical research covers the heat weakening process and heat energy coupling, including study of thermoelastic stresses, and studies of mechanical disintegration by surface chipping and the effect of surface heating. For both of these areas appropriate equations have been derived for the purpose of programming for computer solution. Laboratory research has been directed toward determining the specific energy required to break hard rock with and without thermal weakening. Six rock types are selected as representative of those which are both difficult and costly to excavate. Two heat sources are discussed, with the mechanical energy being provided by a pneumatic hammer.

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SANITARY LANDFILL FACTS

U.S. Environmental Protection Agency. Thomas J. Sorg, and H. Lanier Hickman Jr. 1970. 36 pages.

PB–204 403

Sanitary landfills serve the purposes of getting ride of solid wastes and providing usable land sites. The report provides guidelines on planning, design, operation, and public health aspects of sanitary landfills. Information is given on equipment and facilities needed, initial and operating costs, and maintenance of a completed landfill. Advantages and disadvantages are listed.

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INNOVATIONS IN TUNNEL SUPPORT SYSTEMS

University of Illinois, Department of Civil Engineering. H. W. Parker, R. M. Semple, A. Rokhsar, E. Febres-Cordero, D. U. Deere, and R. B. Peck. May 1971. 263 pages.

PB–204 437

Recent improvements in machine tunnel-boring technology have not been accompanied by comparable improvements in tunnel supports. Although rock bolts and shotcrete are relatively recent advances in the state-of-the-art of tunnel support systems, an unduly large number of tunnels are lined in a manner reminiscent of tunnels constructed in the first part of this century. The discussions and recommendations contained in this report are the principle results of a study on innovative concepts for tunnel support systems. The study included new uses for new materials, use of new materials, and innovations in the design and installation of supports. The investigations were specifically directed toward medium to large diameter (15 to 40ft.) transportation tunnels in both soil and rock. However, many of the ideas are applicable to other tunneling situations.

FLOOD WAVES FROM A CONTROLLED BREACHED DAM

Missouri Water Resources Research Center. T. E. Harbaugh, and D. L. Fread. August 1971. 71 pages.

PB–204 493

Small homogeneous earthfill dams are subject to possible failure from over-topping because of inadequate spillways. Such failures may cause considerable property damage and even the loss of life. A method of alleviating downstream damages from breached earth dams is to provide a relatively thin erosion-retarding layer at an optimal elevation within the dam. Such a controlled breach would produce two distinct flood waves of a reduced amplitude. This paper investigates the reduction in the reservoir release due to the hypothetical erosion-retarding layer. The reservoir flow is simulated by a numerical model. Also, a method is provided for the determination of an optimal location of the layer.

LOAD CARRYING CHARACTERISTICS OF DRILLED SHAFTS CONSTRUCTED WITH THE AID OF DRILLING FLUIDS

University of Texas, Center for Highway Research, Walter R. Barker, and Lymon C. Reese. August 1970. 344 pages.

PB–206 740

The drilled shaft is a construction concept which is finding increased interest as a competitor of the driven pile for heavily loaded foundations. It may be defined as a deep foundation constructed by drilling a hole and filling it with concrete. For axial loads the shaft becomes a concrete column supported vertically by bottom bearing combined with side friction. The capacity of the shaft is said to be increasable by enlarging the base to form a bell. The document discusses the straight drilled shaft, designed for side friction, as more economical than a comparable driven pile foundation. The results of loading tests are presented, along with the results of hydrometer tests in various types of sandy and silty clays. Application to caving soil is given particular attention, and the use of mud as a drilling fluid is described. The information is aimed to aid in establishing design and construction procedures for this technology, as well as to identify some pitfalls. An example of successful utilization of the method is given, involving the construction of an overpass.

Control Systems and Computers

KEY WORD IN CONTEX INDEX AND BIBLIOGRAPHY ON COMPUTER SYSTEMS EVALUATION TECHNIQUES

University of Maryland, Computer Science Center. Sarah Crooke, Jack Minker, and Jeffry Yeh. January 1971. 66 pages.

N71–34183

This indexed bibliography covers the journal, book, and report literature on computer systems evaluation techniques published, for the most part, in the 1960-1970 time period. The documents selected contain information pertinent to the areas of system evaluation, simulation languages, mathematical modeling, and simulation techniques applicable to time-sharing, multiprocessing, and multiprogramming data processing systems.

COST OF AUTOMATION

Union Carbide Corporation. D. R. Davidson. September 1971. 10 pages.

Y–EC–93

To investigate each detail of the cost involved to install, maintain, and operate a numerical control (NC) system in a production facility would take many hours. The purpose of this paper is to bring to the attention of the reader some basic direct and indirect support costs of such an installation. An understanding of these costs can then assist management when a new NC system is to be considered.

Cooling and Ventilating

THE PERIODIC FLOW COOLING TOWER: A DESIGN ANALYSIS

Stanford University, Department of Mechanical Engineering. Robert J. Moffat. June 1966. 72 pages.

AD–489 822

In the period preceding the publication of this report, compact periodic heat exchangers had been developed having area densities on the order of 1500 to 2000 $ft.^2/ft.^3$ and effectivenesses of 0.90

or higher. During this same period, water cooling towers which are energy exchangers using combined heat and mass transfer, continued to use are densities of 10-50 ft.^{2}/ft.^{3}, yielding effectiveness of 0.70-0.75. The high volume units required for even this moderate performance are subject to maldistribution of both the air and the water streams, which further penalizes the performance/size relationship by requiring excess area to ensure performance. The study reported applies design techniques developed for the periodic-flow heat exchanger to the problem of water cooling, with the objective of demonstrating the increase in performance and decrease in size and weight which results from the use of compact surfaces in conjunction with the periodic-flow concept. The same advantages which are demonstrated for the water cooling unit could also be realized for humidifiers, dehumidifiers, and water heating units, by suitable modifications of the design procedure presented.

POWER PLANT HEAT REJECTION IN AN ARID CLIMATE

University of Arizona, Engineering Experiment Station. Frederic C. Scofield III. 1971. 92 pages.

N71–35158

The installation of steam power plants to satisfy the rising demand for electricity will require increasingly large quantities of water to dissipate the heat rejected by evaporative condenser cooling systems. In regions where water is in short supply, the amount of water available may be a design constraint on the plant size. It is therefore imperative when planning a power plant in an arid region that the factors affecting power plant water consumption be identified and controlled to permit reduction of the demand, and that the annual water requirements be accurately determined. In this study, consideration is given to the factors influencing evaporation from a cooling tower, cooling pond, and a cooling pond with a supplemental spray system, and to estimate the monthly annual evaporation for each alternative. To provide a background to the problem of evaporative cooling, the factors affecting the site selection process in a dry climate are first reviewed. Criteria for evaluating water sources are developed; and the three methods of evaporative heat dissipation—cooling tower, cooling pond, and a cooling pond with a spray system—are then investigated. The results are then applied to a typical 800 Mwe nuclear LWR power plant.

A STUDY OF AIR CONDITIONING, HEATING, AND VENTILATING FOR VETERANS ADMINISTRATION HOSPITAL KITCHENS AND LAUNDRIES

Fred S. Dubin Associates. February 1970. 191 pages.

PB–205 402

Environmental control, or space conditioning, is the degree of temperature control, humidity control, ventilation, and air filtration needed to provide tolerable indoor working or living conditions. There are numerous systems and combinations of systems which can be employed to provide a controlled thermal and aseptic environment; each system has its individual characteristics which affect owning and operating costs. The heating, ventilating, and air conditioning systems employed in hospital kitchens and laundries must, in addition to provide comfort, reduce the pathogen count of the air supplied to the building, and reduce the bacteria count which is introduced by personnel and materials to the space. This report is the result of a study undertaken to determine user needs and requirements for environmental control systems for hospital kitchens and laundries; to develop temperature, humidity, and ventilation criteria; to recommend mechanical systems and construction standards; to establish basic criteria that govern and limit mechanical systems, including owning and operating costs; and to determine comparative owning and operating costs of alternative systems. Although the study was done for the U.S. Veterans Administration, many of the results are applicable to hospital kitchens and laundries in general.

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REFRIGERATION-COOLING SYSTEMS FOR RURAL COMMUNITIES IN DEVELOPING COUNTRIES

General Electric Company. December 1962. 45 pages.

PB–206 698

A review and evaluation is provided of alternative refrigeration-cooling systems for application in the rural areas of newly developing countries. The available equipment suited to the needs of these countries is identified, and development opportunities for improved equipment systems are delineated. The scope of the document is restricted to community or village sized facilities for fresh food preservation. A list of equipment manufacturers is included.

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Environmental Engineering

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE

Rand Corporation. L. M. Libby. September 1970. 71 pages.

AD–712 722

FIFTY MORE TIMELY PROBLEMS OF THE ENVIRONMENT

Rand Corporation. L. M. Libby. March 1971. 65 pages.

AD–732 679

Our environment increasingly demands more palliatives and solutions to its perturbations. These documents survey some of the most recognizable and pressing problems of the environment, and include comments on them from the current literature.

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ENVIRONMENTAL ASPECTS OF POWER PLANTS

National Air Pollution Control Administration. L. E. Niemeyer, R. A. McCormick, and J. H. Ludwig. 1971. 18 pages.

COM-71-01042

The magnitude of present emissions of air pollutants from fossil-fuel-burning power plants, and the expectation that they will increase 3- to 5-fold in the next 30 years to meet energy requirement demands, unless presently accepted practice is modified to control such pollutants, clearly requires the complete evaluation of the environmental impact of power plants on local, regional, and global scales of interest. This paper discusses some of the factors relevant to such an evaluation. The topics include the dispersion of effluents from tall stacks; the problem arising from the escape of large quantities of water vapor from cooling towers into the environment; the transformation of sulfur compounds in power plant plumes; and the removal of pollutants by natural atmospheric cleansing processes. Power plant siting is also discussed.

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INTERNATIONAL ASPECTS OF MAN'S EFFECT UPON THE ENVIRONMENT

National Academy of Sciences. Roger Revelle. January 1970. 29 pages.

PB-203 379

This document constitutes a summary report of an Adhoc Committee on Environmental Aspects of Foreign Assistance. Consideration is given to the aspects of AID assistance which have a potential for creating environmental degradation; the problem areas which should receive priority attention; and the ways that AID may strengthen the capabilities of the United States and developing countries in dealing with environmental problems.

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SEPTIC TANKS AND THE ENVIRONMENT

State of Illinois, Institute for Environmental Quality. J. W. Patterson, R. A. Minear, and T. K. Nedved. June 1971. 105 pages.

PB-204 519

This report reviews and evaluates the available literature on septic tanks, and their influence on public health and environmental quality. The topics covered include: Development and operation of septic tanks; extent of use; industrial uses; standards and regulations for septic tank systems; effluent chemical characteristics and effects; clogging of absorption fields; effluent biological characteristics and effects; public health effects; septic tank sludge disposal; surveillance and abatement; research needs.

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AIR POLLUTION ASPECTS OF THE IRON FOUNDRY INDUSTRY

A. T. Kearney & Company, Incorporated. February 1971. 260 pages.

PB–204 712

A systems analysis study of the iron foundry industry is presented with particular emphasis on the melting area. The study presents detailed information on the following topics; Trends of the iron foundry industry; The iron foundry process, (which includes; iron production, raw material storage, furnace charge preparation, iron melting, molding, pouring, shakeout, cleaning, heat treating, finishing, sand conditioning, coremaking, and pattern making); Emissions generated and their control; Recommended procedures for testing particulate emissions from iron foundry cupolas.

THE BARGED DISPOSAL OF WASTES. A REVIEW OF CURRENT PRACTICE AND METHODS OF EVALUATION

Environmental Protection Agency, Pacific Northwest Water Laboratory. B. D. Clark, W. F. Rittall, D. J. Baumgartner, and K. V. Byram. July 1971. 125 pages.

PB–204 868

Waste disposal has been primarily terrestrial but present population and urbanization trends, fostering competition for available land, have necessitated broad searches for economically feasible, alternative disposal techniques. Seaside communities and industries have found that a system of barged ocean disposal of hard-to treat solids and liquids is an economically feasible solution under existing regulations. The primary purpose of this report is to document currently available methods and approaches for evaluating the physical fate and distribution of wastes discharged to the ocean environment. Emphasis is on the local as opposed to global distributions. The report first classifies the wastes giving typical characteristics and reported effects of current operations. A discussion of the theoretical transport mechanisms is then presented. A Methods of Analysis Section explores solution techniques and presents typical examples, followed by a section discussing barging costs. The report is concluded with recommendations for operation and for research, supplemented with an extensive bibliography.

ASBESTOS AIR POLLUTION CONTROL

Illinois Institute of Environmental Quality. Colin F. Harwood. November 1971. 79 pages.

PB–205 238

Asbestos is unique, as a naturally occuring mineral, in the fact that due to its fibrous nature it can be woven. Its industrial usefulness is based on its non-flammability, flexibility, tensile strength, low density, resistance to acids and alkalies, and high electrical resistivity. Unfortunately, this unique and useful material is known to have adverse health effects. This report reviews the sources of emission to the atmosphere and considers the reasonableness and the rationale of the ways in which the emissions may be curbed. Specific topics covered include: Asbestos emissions from nonindustrial sources, manufacturing processes, and product use; control techniques in manufacturing processes; storage and transportation; workers' clothing; alternatives to asbestos; disposal of asbestos waste products; monitoring considerations.

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A STUDY OF ENVIRONMENTAL POLLUTION BY LEAD

University of Illinois, Heavy Metals Task Force. R. B. Snyder, D. J. Wuebbles, J. E. Pearson, and B. B. Ewing. November 1971. 157 pages.

PB-205 239

In many areas lead concentrations are significant in water, air, food, soil, and human beings; moreover, some of these levels are rising. The evidence is that lead is toxic to humans. This report assembles in one place the basic knowledge needed to design a control strategy for lead in the environment. It summarizes what is known about the sources, concentrations, and effects of lead in the environment. Consideration is also given to abatement measures and surveillance and monitoring techniques, including the costs. The recommendations made in the report are directed primarily at the State of Illinois, but many of them should be applicable elsewhere.

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Highway Engineering

MAINTENANCE PROCEDURES: BIBLIOGRAPHY

Texas Transportation Institute. Frederick S. White. November 1971. 87 pages.

PB-205 757

The bibliography is comprised of 261 references to journal articles and technical reports dealing with road maintenance procedures. Each entry is accompanied by an abstract.

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STUDY OF LONGITUDINAL JOINT CONSTRUCTION IN BITUMINOUS CONCRETE PAVEMENTS

Maryland State Roads Commission. Oliver E. Briscoe. May 1971. 52 pages.

PB–206 632

Bituminous concrete paving of two-lane roadways may be performed while maintaining traffic by paving one lane one day and the second lane the next day. The resulting longitudinal joints between these lanes have long been recognized as very vulnerable to the effects of water, weather, and traffic conditions. A study and evaluation were made of several different types of joint construction techniques to aid in obtaining more durable joints. The document reports on cold face joint construction, with the rolling technique varied in the second placed lane to give three methods of joint construction; lap, pinched, and forced joints. Paving mixtures are described, and details of the rolling processes are given. The major indication is that care in forming the joints is the most important factor, with the particular method rather indeterminate at the present stage of study. An improvement of nondestructive tests methods is recommended.

THICKNESS DESIGN PROCEDURE FOR BITUMINOUS RESURFACING OF PORTLAND CEMENT CONCRETE PAVEMENTS

Illinois Division of Highways. Robert P. Elliott. November 1971. 38 pages.

PB–206 659

Analysis of the behavior of a number of bituminous-resurfaced portland cement concrete pavements has indicated that their performance resembles that of a rigid rather than a flexible structure. Based on this finding, a resurfacing design procedure for both first and second resurfacings has been developed by modifying existing procedures for a rigid pavement, utilizing the same format and considering the same design parameters of traffic, soil, support, and material thickness, with the expectation of a maximum service life of about 15 years. The report presents mathematical methods for evaluating traffic and analyzing structural relationships, and design parameters appear in the form of nomographs. Such procedures aid the designer in predicting future traffic and determining the resurfacing thickness required to retain the desired serviceability for the design period. The pavement design is represented by a thickness index called a structural number which is a linear function of portland cement concrete thickness and resurfacing thickness.

Hydraulics and Fluids

FLUERICS: A BIBLIOGRAPHY

Harry Diamond Laboratories. October 1971. 396 pages.

AD–733 300

This bibliography of the literature in fluerics and fluidics technology contains approximately 629 citations of articles, books, and papers, and 399 descriptions of patents and disclosures. Titles of papers published in the proceedings of all major symposia of the last eight years are listed. A subject index (KWIC index) is provided for ready access to the titles of all documents. Corporate author, personal author, and inventor indexes are also provided. A list of organizations from which information on fluidics and fluerics may be obtained is included. This report supersedes AD–709 497 which was announced in AMTID, January 1972, page 35.

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FRICTION FACTORS FOR HYDRAULIC DESIGN OF CORRUGATED METAL PIPE

U.S. Army Engineer Waterways Experiment Station. J. L. Grace, Jr. January 1965. 34 pages.

AD–734 092

Structural plate pipe, widely used in drainage systems, is made of corrugated metal sections bolted together in the field. These sections permit erection of pipe 5 feet in diameter or larger. Structural plate corrugations have a depth of 2 inches and the pitch or spacing of corrugations is 6 inches. In standard corrugated metal pipe, the depth is 2 inches the pitch is 2-2/3 inches. This document reports the determination of friction factors for structural plate pipe. The following data are presented in graphic form: Resistance coefficient versus wall Reynolds number; resistance factor attributable to assembly bolt nuts; resistance versus pipe diameter; Manning's number versus pipe diameter; resistance coefficient versus pipe diameter. Comparable data are provided for standard corrugated pipe.

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HYDRAULIC DESIGN OF ROCK RIPRAP

Army Engineer Waterways Experiment Station. F. B. Campbell. February 1966. 55 pages.

AD–734 097

Blocks or irregular masses of stone, known as riprap, are widely used for shore protection along rivers and harbors, and to make spillways at dams. The serious need for valid criteria for the hydraulic design of riprap has been apparent for some time. This paper summarizes a study of open channel flow conditions affecting riprap design and suggests a design procedure based on hydraulic principles rather than on rule-of-thumb formulas. Riprap design is idealized by study of the stability of a cubical element. Field and laboratory investigations required for the development of firm design criteria are recommended.

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FLUID TECHNOLOGY (SELECTED COMPONENTS, DEVICES, AND SYSTEMS): A COMPILATION

National Aeronautics and Space Administration. 1970. 15 pages.

NASA-SP-5938(01)

A number of fluidic devices and systems developed by or for NASA have potential applications outside of the aerospace industry. The document presents brief summaries on a selected group of fluid components, devices, and systems which may be of particular interest to the designers and manufacturers of hydraulic and pneumatic components, fluid filtration systems, and fluid calibration systems. It also includes several computer programs that may be applicable to fluid technology, and a form for requesting more technical information.

DRAFT TUBE SURGES—A REVIEW OF PRESENT KNOWLEDGE AND AN ANNOTATED BIBLIOGRAPHY

Bureau of Reclamation. H. T. Falvey. December 1971. 25 pages.

PB-206 600

Draft tube surge is a term applied to hydrodynamic instability which forms in the draft tubes of turbines involving swirling flow when the unit is not operating near maximum efficiency. The document contains a literature survey and a review of material related to this surge. The literature survey consists of an annotated bibliography of articles published between 1910 and 1970. The review is restricted to experiments with elementary models, experiments with model and prototype turbines, and field measures to reduce surging. The present knowledge is considered sufficient for predicting orders of magnitude of frequencies and amplitudes. Applications are discussed to hydroelectric power plants, hydraulic machinery, and pumps. Some of the topics treated are velocity distributions, the mathematics of swirling flow, air admission and injection, fins and flow splitters, and characteristics of runner cones and coaxial hollow cylinders.

Industrial Engineering

ENGINEERING DESIGN HANDBOOK. MAINTAINABILITY GUIDE FOR DESIGN

U.S. Army Materiel Command. August 1967. 438 pages.

AD-823 539

The importance of maintainability in equipment design cannot be overemphasized. It is the objective of this handbook, therefore, to influence design so that equipment can be (1) serviced efficiently and effectively if servicing is required, and repaired efficiently and effectively if it should fail, or (2) operable for the period of intended life without failing and without servicing, if possible. The book embraces the extent and nature of the maintenance problem and the principles and techniques that offer a solution to the problem. The various sections of the book are concerned with the extent of the maintenance problem in terms of money, men, and materiel; maintainability objectives, principles, and procedures; the nature of the maintenance problem in terms of the conditions which equipment must be operated and maintained, from the logistical, human, and environmental points of view; design considerations that have general applicability to many types of equipment; and design considerations applicable to some specific types of equipment.

FUNDAMENTAL THEORY AND PROBLEMS RELATED TO LONG RANGE FORECASTING

Office of Aerospace Research, Office of Research Analysis. Ben H. Swett. December 1968. 220 pages.

AD–854 590

Dependable planning for the future is considered as involving two major processes, reliable long-range forecasting and sound decision-making, with proper decisions possible only with competence in forecasting. A system thus fundamentally based on logical processes is analyzed with regard to components and functions. The document discusses the relations of demand and supply to advanced planning, and presents a definition of forecasting which is then related to the generation of knowledge by inductive and deductive logic. A model is drawn for knowledge store and realms of content. The entrance of bias into forecasting is noted, along with potentials for increased reliability and relevance. Criteria are developed for estimating the potential effectiveness of a given forecast or forecasting methodology.

Machinery

ROTOR-BEARING DYNAMICS DESIGN TECHNOLOGY

Mechanical Technology Incorporated, N. F. Rieger. May 1965. 327 pages.

AD–466 390

With continual increase in the operating speeds of modern machinery, an accompanying demand grows for reliable components at higher and higher rotational speeds. Design and development of such mechanisms depends upon a knowledge of the dynamic characteristics of rotors within their bearings. An attempt is made to present the existing knowledge in the major areas of rotor bearing dynamics in a single volume. The document is intended to constitute for each area a comprehensive and definitive introduction to the mechanics of rotors in bearings, plus a documented reference to the subject literature. Systems and forces are discussed, along with the properties of rotor whirl, critical speed, and system stability. Balancing of rigid and flexible rotors is considered, as well as calculation of unbalance and acceptable levels of unbalance. Axial and torsional effects are included.

A NOVEL, HYBRID, TILTING-PAD BEARING

Mechanical Technology Incorporated. Coda H. T. Pan, and Anthony J. Smalley. October 1971. 46 pages.

AD-733 494

A new journal bearing concept for gas and vapor lubrication is described. The concept employs a stable tilting pad bearing operated under combined hydrostatic and hydrodynamic conditions. The development appears promising for meeting problems peculiar to steam driven machinery, such as steam hammer instability when the steam is not dry, whirl instability of fixed journal bearings at high rotational speed, and sensitivity of hydrostatic bearings to the fine particles present in a steam supply. The document presents an analytical approach in which steam is treated as a perfect gas, the advantages of pivoted bearings are outlined, and a number of fluid flow characteristics to be expected in a high speed, high pressure system are discussed. Results of a mathematical analysis are used to establish an effective configuration for the bearing, together with stability characteristics, and experimental comparisons of the new bearing with a plain self-acting tilting-pad bearing of the same size are reported.

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EVALUATION OF GEOMETRY FACTORS IN ROLLER BEARINGS

General Motors, Detroit Diesel Allison Division. Vernon M. Zwicker. November 1970. 45 pages.

AD-879 194

Two types of damage have long been a problem in the technology of cylindrical roller bearings—skidding and end wear. An investigation was conducted to determine the factors or combination of factors involved in this behavior, consisting of a statistically designed experiment using five geometrical and two operational factors, and a statistical analysis of the results. The test was a half replication of a factorial experiment under varying operating conditions of loading and speed to examine the effect of geometric variables. The report is presented with the hope that the data derived from the results can help to advance the state-of-the-art in roller bearing technology. The discussion covers the approach to the problem, the test equipment and methods, and the analytical methodology. Also included are the effects of misalignment, internal and end clearance, flange angle, skewed cage, and roller crowns. Some conclusions are drawn and some recommendations are made.

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Manufacturing Methods

INVESTIGATION OF POSSIBLE ADVANTAGES OF UTILIZING HEATED ROLLS FOR HOT ROLLING METALS

Battelle Memorial Institute. R. J. Fiorentino, J. A. Walowit, F. W. Boulger, and A. M. Sabroff. January 1967. 54 pages.

AD-809 290

FURTHER INVESTIGATION OF POSSIBLE ADVANTAGES OF UTILIZING HEATED ROLLS FOR HOT ROLLING METALS

Battelle Memorial Institute. A. A. Popoff, S. K. Batra, J. A. Walowit, T. G. Byrer, and A. M. Sabroff. May 1968. 67 pages.

AD–836 773

DEVELOPMENT OF A PROCESS UTILIZING HEATED ROLLS FOR HOT ROLLING METALS

Battelle Memorial Institute. A. A. Popoff, T. G. Byrer, and A. M. Sabroff. May 1969. 56 pages.

AD–854 145

STUDIES ON THE APPLICATION OF THE HEATED-ROLL CONCEPT TO HOT ROLLING METALS

Battelle Memorial Institute. A. A. Popoff, T. G. Byrer, and R. J. Fiorentino. June 1970. 39 pages.

AD–871 783

These studies on the use of heated rolls to roll preheated thin metal strips have demonstrated that, when compared with the processing of metals on cold rolls, heated rolls (1) reduce the tendency toward cracking of relatively brittle materials, (2) allow greatly reduced rolling loads when the strip is rolled bare or coated with a molten glass lubricant, and (3) allow heavier per pass reductions. AD–809 290 considers the quantitative effect of rolling variables on temperature distribution in rolled strip, and describes small-scale rolling trials. AD-836 773 concerns analytical techniques for selecting proper roll conductions; the design and fabrication of heated roll equipment; and further experimental rolling studies. AD–854 145 describes rolling studies with tungsten and beryllium; and it evaluates the application of the heated-roll concept to the rolling of thin strip and clad composites, thermomechanical working techniques, and the superplasticity phenomena. In AD–871 783, further evaluation is made of applications of the heated-roll concept to metalworking techniques; in addition a description is given of the evaluation of new roll sleeve materials, and of rolling studies on various metals and alloys.

SURVEY OF DEFORMATION PROCESSES AND DEFORMATION CHARACTERISTICS OF DIFFICULT-TO-FORM METALS

Battelle Memorial Institute. F. W. Boulger, A. F. Gerds, R. L. Jentgen, et al. June 1967. 336 pages.

AD–817 836

The document provides a survey of the available information on deformation characteristics of metals and their effect on processing operations. The objective is to help the nonspecialist in recognizing the implications of findings and in applying them in specific operations. Generalized discussions of common processes point out why specific variables must be modified to deform certain types of metals satisfactorily. When practical, data on the more-difficult-to-form metals are used to illustrate the principles. Some of the sections cover particular reactions and properties that are affected by deformation history which, although of more fundamental interest, may be helpful in designing and exploiting new fabrication techniques. The subjects covered include: Ductile fracture; application of high pressure to the forming of brittle metals; superplasticity; lubrication in metal-deformation processes; swaging; adiabatic conditions in deformation processing; residual stresses produced by deformation.

CHECKLIST OF GOOD CONTAMINATION CONTROL PRACTICES FROM A MANUFACTURING VIEWPOINT

Sandia Laboratories (AEC), Nondestructive Testing Division. Douglas W. Ballard. April 1971. 42 pages.

N71-34418

The contamination control program at a given manufacturing or assembly plant is almost always less effective than required. While the designer bears some responsibility for these problems, many of the problems can be attributed to poorly planned and executed manufacturing practices. This report contains checklists in the form of recommended manufacturing procedures or good practices that have proved useful in establishing and monitoring some of the critical handling, cleaning, and assembly steps in a production facility. These guidelines cover the following major areas of concern from a contamination control viewpoint: Clean room and clean bench operations; ultrasonic cleaning; vacuum bakeout; solvent spraying; vapor degreasing; abrasive spray cleaning; combination vapor degreasers and ultrasonic cleaners; storage of cleaned parts; and personnel selection and training.

APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY, A TECHNOLOGY TRANSFER PROFILE: CONTAMINATION CONTROL

Denver Research Institute, University of Denver. James P. Kottenstette, James E. Freeman, William M. Hildred, F. Douglas Johnson, and Eileen R. Staskin. July 1971. 94 pages.

N72-12418

Need for excluding contaminants has long been recognized in food processing, pharmaceuticals, and photography. Other fields have joined in, as necessity or cost considerations have made the avoidance of contaminants, recently termed contamination control, either essential or advantageous. The first contaminant recognized was airborne dust, in the production of small instruments. The driving force behind the recent developments in this field, however, has been the success of transferring the technology developed in controlling microbes, dust, radiation, or other elements, to industrial uses. The document discusses the essentials of this transfer under the headings of control technology involved, stages in the process, and the matter of whether it is continuing or has terminated. Results of a statistical study are given, and a discussion of clean room technology is included.

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A BIBLIOGRAPHY ON ELECTRICAL DISCHARGE MACHINING AND ELECTRO-CHEMICAL MACHINING

Bettis Atomic Power Laboratory (AEC). W. C. Wahl, and Linda L. Tafel. September 1971. 215 pages.

WAPD–331

This bibliography lists approximately 1100 references on electromachining which were published from 1950 through the end of 1969. All references are from journals, books, and other sources available to the public. Author and subject indexes are included.

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MACHINING AND GAGING INFORMATION. 1970 ANNUAL INDEX

Union Carbide Corporation. A. M. Read, and M. L. Shell. June 1971. 241 pages.

Y–SC–10

This document contains bibliographic entries and abstracts pertaining to the high-accuracy, close-tolerance aspects of machining and dimensional measurement, or to unique applications of equipment and methods. The entries represent technical journal articles, professional society papers, technical reports, and books, most of which were published in 1970. Title, subject, personal author, and corporate author indexes are included. The sources where the publications (other technical journal articles) may be obtained are indicated.

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Mapping and Resource Surveys

NATIONAL RESOURCES SURVEY GUIDANCE MANUAL. RESOURCES ATLAS PROJECT—THAILAND

Engineering Agency for Resources Inventories. Ernest Jackman. November 1971. 241 pages.

AD–734 007

A knowledge of the physical and human resources of a country is necessary for effective national planning. Inventory studies or atlases of these resources bring together under one cover, and often for the first time, the related parts needed for a unified regional resource development effort. This manual was intended to assist the Applied Scientific Research Corporation of Thailand prepare such an atlas for Thailand. Most of the material contained within it, however, is generally applicable. It is designed to meet the need for appropriate instructional and guidance materials not now available, and is structured as a training and guidance aid for the planning and execution of resources inventory studies. The general subject areas covered include planning of resources inventory studies; maps, aerial photography, and cartographic techniques; text preparation; and data storage and retrieval.

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NATURAL RESOURCES-CADASTRAL INVENTORY. NICARAGUAN PILOT PROJECT

Inter-American Geodetic Survey, Natural Resources Division. March 1966. 126 pages.

PB–207 385

In preparation for a comprehensive cadastral and natural resources survey of Nicaragua, a pilot survey was undertaken in an agricultural area in the vicinity of Leon. The primary purpose was to provide orientation for those Nicaraguan specialists expected to occupy leading roles in the planning and execution of the comprehensive survey. The pilot survey was also intended to develop data useful to the solution of specific problems of the survey area, such as the use of water for irrigation. This report presents a description of the geology, geomorphology, climatology, hydrology, soils, land use, and cadastral aspects of the region as determined by the survey. An evaluation of the resource data is also presented, with particular attention being given to land-use potential and problems of the area.

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PRODUCTION OF CADASTRAL MAPS

Engineer Agency for Resources Inventories. September 1971. 55 pages.

PB–207 633

This report was prepared as part of an effort to prepare a procedural plan for the adaption of ongoing orthoptico mapping for the use in land reform administration in Vietnam. The procedure proposed in this report entails a trade-off in quality of photographic resolution in order to take advantage of new automated production techniques. The result is a reduction in technical effort and an increase in the speed of production. The project made it possible to demonstrate the utility of aerial photographic imagery as a basic tool in identifying and cataloging plots of land available for distribution as to precise position, shape, size, and relationship to neighboring parcels; as well as in recording the information as a cadastre in support of legal titles when distribution occurs.

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STUDY OF CONSTRUCTION METHODS FOR LARGE UNDERSEA CONCRETE STRUCTURES

Santa Fe-Pomeroy Incorporated. Ben C. Gerwick Jr., W. J. Talbot Jr., P. Y. Chow, A. L. Brown, H. A. Brauner, and J. B. Adams. September 1971. 175 pages

AD–732 794

The use of concrete for the construction of ocean bottom structures is receiving increased attention, both because of its ability to replace steel for such structures and because of its inherent qualities for undersea engineering The document presents an outline of operational technology for concrete and reinforced concrete, the state-of-the-art in methods of fabrication and forming, quality control, materials to improve concrete performance, launching and towing of concrete structures to sites, sea floor emplacement, and problems of technical nature. Recommendations are made in light of economic and other considerations, and possibilities are indicated for future advancement in the field. A report is made on investigative research on prestressed concrete, reinforcement methods, materials for impregnation and strengthening, and underwater operations. In addition the evaluation of each offshore site in light of its particular set of geographical conditions is called to attention, with variables considered for water depths up to 1000 feet.

EXPLOSIVE ANCHOR FOR SALVAGE OPERATIONS—PROGRESS AND STATUS

Naval Civil Engineering Laboratory. J. E. Smith. October 1971. 44 pages.

AD–735 104

A new type of ship anchor, designated explosive anchor, is being developed to replace the traditional style for duty on a hard ocean bottom, particularly for cargo salvage of stranded ships in a coral environment. The document discusses a 6-ton steel blade at the end of a cable, carried to deep submergence by a retrievable vehicle and driven by explosive charge into the sea floor. The blade is expendable. Associated equipment, ordnance system, launch vehicle, cable assembly, and technique are described and appraised, along with indications for further development growing out of test programs and data analysis. Since it is desired to incorporate as broad a range of salvage anchoring capabilities into the anchor as practicable, the investigation includes possibilities for operation on sea floors of sand and mud as well. Aside from the dragging difficulties inherent to conventional anchors, the new technology is aimed to shorten the response time to attending to a stranded ship with limitation of damage to the ship and its cargo.

MARINE DECISIONS UNDER UNCERTAINTY

Massachusetts Institute of Technology. John W. Devanney Ill. November 1971. 217 pages.

COM–71–01088

The objective of this monograph is to facilitate the application of Bayesian decision theory in the marine industry. It is felt that people at two separate levels have to be addressed if a much broader and more systematic application of modern decision theory in marine operations can be affected. Practicing marine decision-makers have to be introduced to the basic concepts of decision-making under uncertainty at an elementary level in the context of problems with which they are familiar. Analysts who have the background need illustrative examples which bring the full force of these ofttimes powerful techniques to bear on some of the more challenging problems facing the marine investor and operators. The first three chapters constitute an elementary introduction to decisions under uncertainty, Bayesian decision theory and dynamic programming respectively. They assume no prior knowledge of these techniques. The final three chapters apply these techniques to a hopefully representative spectrum of marine problems involving substantial uncertainties. These problems include: (1) the alternatives facing decisionmakers who operate in the ship charter markets, both owners and charterers; (2) marine hardware maintenance, especially the design of maintenance and replacement policies when only limited failure data are available; and (3) search and exploration at sea.

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UNDERWATER SOIL SAMPLING AND TESTING. STATE-OF-THE-ART REVIEW

San Diego State College, Department of Civil Engineering. I. Noorany. June 1971. 74 pages.

COM–71–01124

The growing interest in oceanic explorations and the expansion of offshore foundation engineering projects during recent years have simulated some novel engineering activities related to submarine soils. Because of the conditions prevailing in the ocean environment, the tools and methods of sampling and in situ testing are often different from the techniques used for soil and geological investigations on land. Practical methods for underwater soil engineering are still in the formative stages, as there is very little past experience to rely upon. The purpose of this review is to bring together and summarize the current state of practice of sea floor soil explorations for engineering purposes. Methods of near surface sampling, as well as deep-penetration sampling, are discussed. Underwater in situ tests and their performance record are examined. The problem of the influence of sampling on submarine soil is briefly discussed, and attention is drawn to the areas which require concentrated research.

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TOPICS IN OCEAN ENGINEERING—SEMINAR PROCEEDINGS

Oregon State University, Engineering Experiment Station. January 1971. 181 pages.

COM–72–10008

Ocean engineering is a developing field where existing engineering technologies are being extended to effectively develop the resources of the marine environment. To promote greater understanding of ocean engineering techniques and to identify areas of needed research, a series of weekly lectures was arranged during the Winter Quarter of 1971 on the Oregon State University Campus. This document is comprised of the papers presented during the lecture series. Their topics are as follows: Ocean food resources and the future of mariculture; Ocean zones and boundries; Use of estuaries for navigation and port development; Engineering in navigable waters; Pollution—the crime of the times; Environment and technology in marine mining; Some considerations for buoys and their moorings; Waves and their effects on pile-supported structures; A brief review of the moored instrumentation platforms used for oceanographic research at Oregon State University; Corrosion in the marine environment.

PROCEEDINGS OF THE THIRD DREDGING SEMINAR

Texas A & M University, Center for Dredging Studies. John B. Herbich, David R. Basco, and Dennis W. Lang. August 1971. 93 pages.

COM–72–10069

The document is comprised of papers presented at a symposium on dredging which was held College Station, Texas, 20 November 1970. The titles of the papers are: Particle size and density effects on cavitation performance of dredge pumps; Materials used in the manufacturing of dredge pumps; Report on world dredging conference (WODCON '70); Research needs of the dredge pump manufacturing; Slurry flow in vertical pipes; Water quality and the dredging industry.

PORT AND HARBOR DEVELOPMENT SYSTEM

Texas A & M University, Architecture Research Center. August 1971. 145 pages.

COM–72–10238

Until recently, the world's ports and harbors could be designed by examination of models from the past. But rapid communication and economic pressures of world trade have so shortened the gap between scientific breakthrough and technological implementation that models from antiquity no longer suffice. Ports and harbors of the future must be designed to accommodate change. The purpose of this report is to aid those who are involved in and responsible for port and harbor planning and design. It is hoped that through the guidelines presented, marine facilities may be developed which are more rational, more flexible, and thus more functional. The first section of the report presents harbor design features. This is followed by a step-by-step description of requirements in port design and construction. Important trends in marine and transportation technology are described, and planning and design concepts are suggested for ports in different stages of development.

Metrology

PRECISION MEASUREMENT AND FUNDAMENTAL CONSTANTS

National Bureau of Standards, Institute for Basic Standards. D. N. Langenberg, and B. N. Taylor. August 1971. 543 pages.

COM-71-50398

Precision measurement plays an essential and crucial role in the development of all science and technology. Scientific theories cannot be tested, instruments and machines cannot be designed and built, and even the daily routine of the market place cannot proceed without precise quantitative measurement. The demand for precision and accuracy is greatest at the frontiers of science and technology. Here our increasing understanding of the fundamental nature of the universe and our increasing ability to put our knowledge to practical use depends on continuing refinement of our theories and of the technology used in testing these theories against reality. This volume presents the Proceedings of the International Conference on Precision Measurement and Fundamental Constants, held at the National Bureau of Standards in Gaithersburg, Maryland, from August 3 through August 7, 1970. The conference brought together theoretical, experimental, and applied scientists for the purpose of discussing modern techniques of precision physical measurement and their application, along with modern theoretical developments, to the determination of the fundamental constants. The topics covered were: frequency and time standards; length standards; the velocity of light; the Rydberg constant; electrical standards; the proton gyromagnetic ratio; the Faraday constant; atomic masses; the proton magnetic moment; Josephson effects; x-rays; fine and hyperfine structure in simple atoms; lepton g-factor anomalies; the gravitational constants; least squares adjustments of the constants. Also included are the post-paper discussions and a panel discussion entitled "Should Least Squares Adjustments of the Fundamental Constants be Abolished?"

METROLOGY AND STANDARDIZATION IN LESS-DEVELOPED COUNTRIES: THE ROLE OF A NATIONAL CAPABILITY FOR INDUSTRIALIZING ECONOMIES

National Bureau of Standards. H. L. Mason, and H. S. Peiser. December 1971. 390 pages.

COM–72–50044

Industrialization of a developing economy calls for a technological infrastructure to deal with problems of stimulating enterprise, assessing alternative courses, choosing manufacturing methods, and controlling product quality. In these tasks, measurement science and engineering standardization have an important role; yet with different governmental philosophies and economic structures, the needs and priorities of government action will vary greatly. This document is comprised of papers presented at a seminar organized by the National Bureau of Standards in an effort to learn how its experience in metrology and standardization for the science and technology of U.S.A. might be used most effectively for less developed countries. Participants came from Argentina, Brazil, Ethiopia, Ghana, Guatemala, India, Israel, League of Arab States, New Zealand, Peru, and Vietnam; from several international agencies; and from industries, professional societies, and government in U.S.A. The papers presented and the informal discussions were organized around the session titles: The Sociological, Economic, and Managerial Environment in Industrializing Countires; Making Scientific and Technological Measurement Meaningful; The Dissemination of Information; Promoting More Effective Use of Science and Technology; Additional Case Histories; Promoting Economic Strength and Commercial Equity; Guidance for NBS Technological Assistance Effort. It was concluded that industrializing economies would benefit from NBS activities in these fields, and specific suggestions were offered to that end.

PRECISION MEASUREMENT AND CALIBRATION. VOLUME 7. RADIOMETRY AND PHOTOMETRY

National Bureau of Standards, Institute of Applied Technology. H. K. Hammond III, and H. L. Mason. November 1971. 685 pages.

COM–72–50067

This volume contains reprints of more than 60 items on radiometry and photometry published between 1957 and 1970. The topics covered include general radiometry, emissivity standards, emissivity measurements and techniques, material properties, irradiance standards, radiometric measurement techniques, radiance standards, flux measurements, reflectometry, general photometry, projectors, and flashing lights. The contents have been selected as being useful to standards laboratories in tracing to NBS standards the accuracies of measurement needed for research work, factory production, or field evaluation.

WIRE ROPE APPLICATIONS AND PRACTICES ASSOCIATED WITH UNDERGROUND COAL MINING IN THE UNITED STATES

Battelle Memorial Institute. C. H. Larsen, R. A. Egen, R. D. Jones, and H. A. Cress. June 1971. 273 pages.

PB–204 077

Wire rope as a machine and structural component has been in use for about a century. During most of this period the problems that it presented to users were solved in many instances by making it larger or stronger or by empirically determining a constructional configuration which "worked better". The user of wire rope in mine hoists has historically been faced with the question of when to replace the rope. In many mining countries efforts to understand the behavior of wire rope and to learn how to design for it have been initiated principally as a result of deaths or gross destruction following hoist-rope failures. The program reported was conceived to study the use of wire rope in U.S. coal mines—man-hauling ropes in particular—to determine the service conditions and usage practices with the aim of improving rope practices and so to avoid tragic accidents. The efforts of the program have determined the following information, which is reported in this document. Design, installation, maintenance, inspection, and repair practices associated with hoisting applications for rope; the major uses of wire rope in nonhoisting appliances associated with underground coal mining; engineering details of these applications and rope maintenance, inspection, and replacement practices; U.S. state and Federal regulations for ropes hoisting in coal mines and, to a lesser extent, in noncoal mines; Canadian and other non-U.S. regulatory practices for ropes and hoisting in underground coal and noncoal mines; general current capabilities and limitations of electromagnetic rope-inspection devices; specific capabilities and limitations for one in particular; the practices and attitudes of U.S. manufacturers of mining equipment using or associated with rope in coal mines; the practice and attitude of U.S. and some non-U.S. manufacturers of wire rope used in underground coal mines; and some attitudes of state regulatory officials, cognizant industry people, and faculty members of schools of mines about wire rope and hoisting in coal mining.

PREDICTION OF LOW-TEMPERATURE CARBONIZATION PROPERTIES OF COAL IN ADVANCE OF MINING

Bureau of Mines, Denver Mine Systems Engineering. Manuel Gomez, and Donald J. Donaven. 1971. 94 pages.

PB–204 132

It is generally recognized that it is technically feasible to carbonize all ranks of coal at low temperatures. Both coking and noncoking coals may be carbonized rapidly in continuous retort systems to produce either tar at maximum yield or char of specified properties. The major potential use for low-temperature char is thermal generation of electric power. Some of these chars have a heating value almost as high as the wet heating value of the original coal. The decision to carbonize coal is generally based on economic conditions. Decisionmakers require advance information on the quantity of coal available for extraction, the mining conditions in the target area, and the properties of the coal to appraise its market value. To be used effectively, this information should be available to the economist and the chemical engineer, as well as to the mining engineer, in the exploration phase of mining. The purpose of this report is to (1) present those variables that may be measured and collected during exploration that are good predictors of the carbonization properties of coal, (2) construct prediction models suitable for forecasting carbonization properties of coal in advance of mining, (3) demonstrate the validity of the prediction models for a wide range of coals, and (4) utilize the models developed, in conjunction with computerized plotting techniques, to forecast carbonization properties of coal and char or coke characteristics on a regional basis.

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FOAM SUPPRESSION OF RESPIRABLE COAL DUST

Monsanto Research Corporation. I. O. Salyer, S. M. Sun, J. L. Schwendeman, and A. L. Wurstner. December 1970. 65 pages.

PB–204 522

In recent years it has become clear that many coal miners develop the so-called "black-lung" disease, which is more appropriately designated as "pneumoconiosis". The control and suppression of respirable coal mine dust is necessary for the prevention of this disabling disease. The suppression of coal dust has now been shown to be feasible in laboratory work. A 90-95% reduction in the level of dust was achieved when foams were used. A foam formulation was developed that can be used to suppress respirable coal dust. It also binds the wetted coal dust and thus reduces the possibility of reaerosolization.

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THERMAL-CHEMICAL ALTERATION OF SANDSTONE TO INCREASE PERMEABILITY

Bureau of Mines, Bartlesville Energy Research Center. Larman J. Heath, and Ray A. Jones. 1971. 26 pages.

PB–205 644

Most gas-storage and many gas-producing reservoirs have adequate storage capacity but would benefit from improved permeability. During peak demand periods, the lack of formation permeability adjacent to the wellbore often limits gas production.

The tests reported demonstrated that the burning of liquid incendiaries (fuel-oxidant mixtures) within the interstices of sandstone reservoir material is technically feasible, and that the heat of burning can significantly increase permeability. The effects of various burning parameters and incendiary mixtures are reported.

Nondestructive Testing

A THERMAL COMPARATOR FOR NONDESTRUCTIVELY EXAMINING FIBER COMPONENTS

Stanford University. J. I. Craig, S. Smith, and W. H. Horton. September 1971. 55 pages.

AD–733 373

Statistical methods of evaluation of engineering materials cannot ensure an acceptable level of reliability and integrity of many engineering systems. Thus, nondestructive test procedures which can be applied at all steps of construction or operation are of paramount importance. A device is described in this report which has been designed principally to determine nonconformities, including inclusions and construction variations, in multilayer glass fiber reinforced plastic sheets. The principal advantages of the instrument are its simplicity of design and operation, and its very modest cost. A series of test results for metallic and nonmetallic inclusion detection is presented. The applicability to thickness determinations is examined, and several promising uses of the device are suggested..

NON-DESTRUCTIVE TESTING: ULTRASONICS

Defense Documentation Center. November 1971. 102 pages.

AD–733 700

The document is comprised of abstracts of U.S. Government reports dealing with the application of ultrasonic radiation to non-destructive testing. The subject matter represented includes ultrasonic techniques for inspection of welds, thickness measurements, flaw detection, evaluation and characterization of materials, fatigue damage, and crack detection. The reports listed are available from NTIS. Indexes are included.

NON-DESTRUCTIVE TESTING: METHODS, TECHNIQUES, AND THEIR APPLICATIONS

Defense Documentation Center. December 1971. 151 pages.

AD–733 850

As the designation implies, non-destructive testing is examination of the qualities of a structure or material by means which do not affect its substance or integrity. Visual, magnetic, ultrasonic, infrared, and similar techniques are utilized for such testing. The bibliography is a compilation of U.S. Government-funded reports on the subject, including methods, techniques, and applications.

The references are grouped under eight major headings: Lasers, eddy currents, electrical, magnetic, visual, thermal, stresses, pressure and leak characteristics, and miscellaneous. Entries cover the period 1953 through September 1971. The reports listed are available from NTIS.

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NON-DESTRUCTIVE TESTING: RADIOGRAPHY

Defense Documentation Center. November 1971. 83 pages.

AD-733 860

The bibliography is a compilation of abstracts of U.S. Government-funded reports on the use of radiography in non-destructive testing. Listings are given pertaining to radiographic techniques for use in the inspection and evaluation of electronic parts, fatigue of plates and weldments in steels, evaluation of metal fatigue, lack of penetration in aluminum fusion welds, small scale footing tests in clay, and evaluation of void content in epoxy-glass filament wound materials. Other topics treated are X-rays, gamma rays, plastics, crystals, test methods, soils, radioactive isotopes, and ultrasonic radiation. The reports listed are available from NTIS.

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Nuclear Technology

CONFERENCE ON INNOVATIVE APPLICATIONS OF RADIATION

Southern Interstate Nuclear Board, and Texas Radiation Advisory Board. April 1971. 86 pages.

CONF-710428

The document is comprised of some of the papers presented at a conference on new applications of nuclear radiation, which was held at Dallas, Texas, 21-23 April 1971. The papers included are: Energy dispersion x-ray (EDX) analysis in the non-ferrous mining industry; Project Rulison—a new approach to the energy shortage; Radioisotope instruments in pollution measurement and control; The successful uses of radiation in agriculture.

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PROCEEDINGS OF THE THIRD INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS

U.S. Atomic Energy Commission. 1971. 502 pages.

CONF-710801 (Vol. 1)

PROCEEDINGS OF THE THIRD INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS

U.S. Atomic Energy Commission. 1971. 560 pages.

CONF-710801 (Vol. 2)

This two volume set is comprised of most of the papers presented at a symposium on the packaging and shipping of radioactive materials which was held at Richland, Washington, 16-20 August 1971. Volume 1 contains papers grouped according to the following general subject areas: U.S. regulations; international regulations; isotopes and waste packaging technology; accident experience; shipment of UF6; spent fuel—experience and problems. Volume 2 contains papers covering the following topics: Insurance and radiation safety; spent fuel packaging technology; administrative experience; nuclear safety; non-irradiated fuel packaging technology; needs and progress in standardization; new spent-fuel cask designs; advanced technology.

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HERMES—A DIGITAL COMPUTER CODE FOR ESTIMATING REGIONAL RADIOLOGICAL EFFECTS FROM THE NUCLEAR POWER INDUSTRY

Hanford Engineering Development Laboratory (AEC). J. F. Fletcher, and W. L. Dotson. December 1971. 781 pages.

HEDL–TME–71–168

With the increasing use of nuclear energy for electrical generation, considerable attention has been focused on the question of the radiation dose to man which might result in the future from large scale use of nuclear facilities in the electric power industry. In an attempt to provide rational estimates of the dose which might be expected, a computer model was developed to estimate the release of radionuclides to the environment, and the resultant population dose, within a geographical region as a result of the operation of nuclear facilities within that region. The computer model is designated HERMES (Hanford Engineering Regional Model for Environmental Study). In this report the component codes of the HERMES model are described, and their design and intended use are discussed. The report narrative discusses the general philosophy of operation of each code; and the appendices give detailed listings and supporting data to assist in operation of the codes.

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COMPILATION OF NATIONAL AND INTERNATIONAL NUCLEAR STANDARDS (EXCLUDING U.S. ACTIVITIES)

Oak Ridge National Laboratory (AEC), Nuclear Safety Information Center. J. Paul Blakely. September 1971. 129 pages.

ORNL–NSIC–94

The document presents in simple tabular form all known national and international nuclear standards, except those of the United States. The standards activities of all national organizations, technical societies, etc., as well as relevant regulations established by government agencies, are listed in alphabetical order by country or by international organization. A permuted title index is included.

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EXPORT AND IMPORT OF MATERIALS AND FACILITIES CONTROLLED BY THE ATOMIC ENERGY COMMISSION. A GUIDE TO AEC EXPORT AND IMPORT REGULATIONS

U.S. Atomic Energy Commission, Division of State and Licensee Relations. Jerome Saltzman. 1971. 75 pages.

WASH-1163

This handbook is designed primarily as a working reference for customs officers, but it may also be of interest to those desiring a reference set of model regulations and those desiring to export to or import from the United States those materials and facilities subject to regulation by the AEC. The commodities of concern include radioisotopes formed as a byproduct of nuclear fuel processing operations; all forms of uranium, thorium, and plutonium; and all nuclear reactors. The first part of the handbook sets out the actual provisions of the pertinent AEC regulations. This is followed by a section containing general information pertaining to exports and imports, and supplementary material designed to further explain some relevant terms and symbols. Packaging and labelling associated with shipments of AEC-controlled material are then discussed. A directory is included of AEC offices that can provide answers to or assistance with questions pertaining to AEC-controlled commodities.

Power Sources

A PROBABILISTIC MODEL FOR ESTIMATING THE OPERATING COST OF AN ELECTRIC POWER GENERATING SYSTEM

Oak Ridge National Laboratory, Chemical Technology Division. D. S. Joy, and R. T. Jenkins. October 1971. 42 pages.

ORNL-TM-3549

The concept of using a probablistic simulation for estimating the operating cost of power generating plants within an electrical utility was first introduuced in 1967, and has recently been gaining acceptance. Basically, the probabilistic simulation techniques develops the cost of operating a utility system over an extended period of time by forcasting the power to be generated by each plant. The major advantage of the technique is its capability for simulating the effects of random events such as unit forced-outages. This report describes the basic probabilistic simulation model and modifications that have been made to represent more effectively the operation of large thermal units during low load periods and to take into consideration the effect of hydroelectric and pumped-storage units. The model is versatile and can be modified easily. It may be used as a subroutine for estimating operating costs in conjunction with optimization techniques for studying utility planning problems.

PRELIMINARY REPORT OF FIELD SURVEY TEAMS ON THE GENERATION AND UTILIZATION OF POWER IN RURAL AREAS OF DEVELOPING COUNTRIES

General Electric Company. September 1962. 204 pages.

PB–206 798

The report presents the principal impressions and tentative conclusions of field investigations on the generation and utilization of electric power in rural areas which were conducted in India, Chile, Colombia, and Peru. The first part of the report provides a general review of existing rural electrification programs in India and Colombia. The remaining portions contain the observations of the field survey teams on the significance of small scale power units from the standpoint of village development programs.

SMALL-SCALE POWER SUPPLIES FOR RURAL COMMUNITIES IN DEVELOPING COUNTRIES

General Electric Company. March 1963. 120 pages.

PB–206 800

The report describes and evaluates alternative small-scale technologies for supplying electric energy to rural communities in developing countries. It appraises the technical suitability of currently available small-scale power supplies, and delineates near-term and far-term development opportunities for improved equipment systems. The technologies considered include: Internal combustion engine generators; small scale hydroelectric plants; thermal vapor engine generators; gas turbine generators; wind generators; photovoltaic solar cells; thermoelectric generators; and fuel cells.

GENERATION AND UTILIZATION OF POWER FOR RURAL COMMUNITIES IN DEVELOPING COUNTRIES. SUMMARY REPORT

General Electric Company. May 1963. 39 pages.

PB–206 801

The report integrates and summarizes the principal findings and recommendations of a research project on the generation and utilization of power for rural communities in developing countries. The principal objective of the project was to assess the need for and significance of electric power for the development of rural communities, with particular attention to the utility and feasibility of small scale power supplies as a means of providing power to village communities. The specific areas of concern included: Small- and intermediate-scale generating plants and grid connections for rural communities; utilization of electric power in rural communities for irrigation, rural industry, and illumination; technical appraisal of potential small-scale power sources, refrigeration-cooling systems, and water treatment processes; and technical support for rural development.

APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY, A TECHNOLOGY TRANSFER PROFILE: FIRE SAFETY

Denver Research Institute, University of Denver. James P. Kottenstette, James E. Freeman, Conrad R. Heins, William M. Hildred, F. Douglas Johnson, and Eileen R. Staskin. July 1971. 74 pages.

N72-12966

The annual loss of property and lives by fire has always been of serious concern throughout the nations of the world, but the increasing use of new flammables and explosives in many fields of engineering, such as liquid gases, synthetic fibers, and plastics, is making improved methods of fire prevention and extinguishment more and more urgent. The document is concerned with fire safety research, particularly with respect to the manufacture, handling, and storing of hazardous materials. The treatment, processing, and formulation of nonflammable and fire retardent materials, such as certain fibers, fluorinated elastomers and polyurethane foams are discussed as means for firemen, safety officers, and protection specialists to make substantial progress in the methodology of avoiding, controlling, and quenching fires. Transfers of space engineering technology to other fields are considered with respect to given industries, useful technologies, and user operations.

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REPORT ON 1970 AID NATIONAL DISASTER PREPAREDNESS PLANNING SEMINAR

Institute for Defense Analysis, International and Social Studies Division. Charles E. Fritz. January 1971. 88 pages.

PB-197 851

The document summarizes a seminar on emergency preparedness planning which was conducted over a five week period from 1 November to 4 December 1970. Representatives from Barbados, Korea, Pakistan, Philippines, Turkey, and Venezuela attended. The purpose was to aid in the assessment and improvement of the national disaster relief operations and plans of these countries and to conduct training programs for the seminar participants. Primary emphasis was focused on the operational aspects of the individual country plans, with workshops and presentations designed to meet country requirements.

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CLASSIFICATION TEST METHODS FOR FLAMMABLE SOLIDS

Bureau of Mines, Pittsburgh Mining and Safety Research Center. J. M. Kuchta, and A. F. Smith. 1972. 13 pages.

PB-206 463

The report concerns flammable solids for which no classification test method is given in the transportation regulations. According to these regulations, a flammable solid is defined as any solid material, other than an explosive, which can be readily ignited or which can cause or contribute significantly to fire under the conditions encountered during transportation. Thus, to classify such materials, it is necessary to consider both their ignitability and flame spread behavior. Since existing test methods were not considered adequate for this purpose, new methods were developed which are described. A rotating disk ignition apparatus and a flame-spread-rate apparatus are proposed for determining the ignitability and flammability, respectively, of most flammable solids. Extremely flammable solids, such as pyrophoric materials, are evaluated by determining their ease of spontaneous ignition in an environmental chamber at high-humidity conditions. Data are presented for various representative solids to show the reliability of the test methods for classifying the materials. A classification system is also proposed for use in government transportation regulations.

KRYPTON 85. A REVIEW OF THE LITERATURE AND AN ANALYSIS OF RADIATION HAZARDS

Environmental Protection Agency, Twinbrook Research Laboratory. William P. Kirk. January 1972. 68 pages.

PB–207 079

Krypton-85 is a long-lived, fission product, noble gas which is released to the atmosphere in large quantities by the nuclear industry, primarily by reactor fuel reprocessing plants. Although development of the technology needed to collect the Krypton-85 at reprocessing facilities is nearing fruition, the atmospheric build-up of krypton-85 is expected to continue for some time due to the rapid growth of the nuclear power industry. This report is intended to: Furnish physical, chemical, and radiological data on ^{85}Kr; review sources, yields, and amounts released in different operations; review the current maximum permissible concentrations in air values and their rationale; review the status of ^{85}Kr as an environmental contaminant and proposed methods of control; enumerate a number of uses for ^{85}Kr in science, especially medicine and industry; evaluate the radiation hazard associated with ^{85}Kr and relate it to existing limits; and review methods that have been successfully used to collect, prepare and analyze ^{85}Kr. A bibliography of 280 items is included.

Soil Mechanics

COMPARISONS OF ENGINEERING PROPERTIES OF SELECTED TEMPERATE AND TROPICAL SURFACE SOILS

U.S. Army Engineer Waterways Experiment Station. June 1966. 241 pages.

AD–486 478

An appreciable amount of knowledge has been obtained on the physical characteristics of surface soils of temperate climates, and this information has been used to identify the engineering properties of given soil types. Because relatively little work of this nature has been conducted on soils of tropical climates, a study was undertaken to determine the extent that data obtained from temperate soils could be transposed to analogous tropical soils. This document contains the results of the study, which involved the comparison of a large number of properties obtained from 11 temperate and 17 tropical soils. The comparative data are presented in both tabular and graphic form. In general, it was found that temperate and tropical soils of similar parent materials and Atterberg limits have other engineering properties that are similar and behave similarly when subjected to standard laboratory tests. Differences in behavior that may exist can be attributed, for the most part, to differences that are not measurable by the Atterberg limits.

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AN INVESTIGATION OF THE CEMENT REQUIREMENTS FOR SOIL CEMENT COMPACTED TO MODIFIED MAXIMUM DENSITY

Army Engineer Waterways Experiment Station. Jon Enrique Windham. November 1968. 84 pages.

AD–730 736

The construction of durable roads requires the placement of strong roadbeds able to withstand natural heaving processes in addition to traffic loading. The idea of mixing cement with soil in order to form a more effective material for highway foundations has been added to the long established processes of optimum soil compacting. The document reports on an investigation in which various amounts of compacting, moisture content, and cement ratio were combined in seeking maximum performance. The major aim was to develop a laboratory test technique for two types of soil: a clay-sand and a silty clay. The discussion includes soil description, type and preparation of cement, moisture-density testing, molding of samples for wet-dry, freeze-thaw, and compressive strength tests, and calculations. Of particular concern is the application to airfield pavements.

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THE RELATIVE STABILIZING EFFECT OF VARIOUS LIMES ON CLAYEY SOILS

California State Division of Highways, Materials and Research Department. M. L. Alexander, R. E. Smith, and G. B. Sherman. September 1971. 31 pages.

PB–204 370

The relative soil stabilizing effects of two hydrated limes and three quicklimes of various grades are discussed. The effects of variations in lime gradation and calcium hydroxide content on the unconfined compressive strength of three different soils are presented. Correlations are also established between lime gradation and compactability, between specimen density and compressive strength. In general, the data indicate that quicklime is more effective than hydrated lime for improving compressive strength, and that higher strengths are obtained with coarser quicklime products than with those ground excessively fine.

CHEMICAL STABILIZATION OF SOILS

Bureau of Reclamation, Engineering and Research Center. W. R. Morrison. June 1971. 51 pages.

PB-205 800

In slope excavation and embankment construction, unstable or erodible soils are often encountered. Economic stabilization of these soils is highly desirable. Methods are also needed for sealing clay and shale areas in slope or tunnel excavation to prevent the sloughing of soil material due to moisture loss. This report represents the results of laboratory and field evaluations of various potential petrochemical soil stabilizers. The materials evaluated included: A sprayable liquid vinyl polymer; a water soluble acrylic copolymer; a high-strength synthetic rubber emulsion; and epoxized-slicone material; three liquid asphalt prime materials; and two petroleum resins.

ENGINEERING STUDY OF LATERITE AND LATERITIC SOILS IN CONNECTION WITH CONSTRUCTION OF ROADS, HIGHWAYS, AND AIRFIELDS. PHASE I—SOUTHEAST ASIA (THAILAND)

Soil and Pavement Consultants of Southeast Asia. B. A. Vallerga, J. A. Shuster, A. L. Love, and C. J. Van Til. June 1969. 379 pages.

PB–207 399

There are a number of soils, principally those referred to as laterites and lateritic soils, which are found in Southeast Asia and other tropical environments, but are essentially unknown in countries of the temperate zones. There has been insufficient engineering information available to determine, with a desirable degree of assurance, how these soils can best be used in road construction. In an effort to remedy this lack, this document provides the results of field studies carried out in Thailand on lateritic soils. Included are reports on background studies of the literature and of geology, the development of a classification system for the soils pavement evaluation studies, and special studies on durability, stabilization, and dynamic properties. The results of the study appear in the form of recommended design methods and design criteria for flexible pavements, specific recommendations regarding construction specifications, and the outline of a usage manual. Although the work was directed toward construction for roads, highways, and airfields, what has been accomplished should also prove of value to the utilization of lateritic materials in civil engineering works of all types, including earth structures and foundations for buildings.

USAGE MANUAL FOR SAMPLING AND TESTING LATERITE AND LATERITIC SOILS AND OTHER PROBLEM SOILS OF AFRICA

Lyon Associates, Incorporated, and Building and Road Research Institute (Ghana). 1971. 63 pages.

PB–207 618

Soil testing is an important and integral part of highway design and construction. This manual has as its purpose the provision of basic details on: Identifying the various soils; the laboratory equipment required to perform the tests; exploration and sampling techniques for soils; and laboratory test procedures. The format is straightforward and simple with many illustrations provided. It is expected that even inexperienced engineers and technicians will find the manual relatively easy to use in the field.

LATERITE AND LATERITIC SOILS AND OTHER PROBLEM SOILS OF AFRICA

Lyon Associates, Incorporated, and Building and Road Research Institute (Ghana). June 1971. 314 pages.

PB–207 636

Roadway design practices in the tropics have evolved, by and large, from American and European experience. The adequacy of these procedures, which were devised through experience with temperate zone soils, have never really been evaluated for the climatic conditions, the soils, and the traffic patterns of Tropical Africa. It was therefore decided that lateritic materials, so plentiful in tropical areas, should be studied in a thorough research program. This document represents the results of such a study carried out in Tropical Africa, with emphasis on Ghana. A review of the pertinent literature is provided for both lateritic soils and tropical black clays, and the engineering properties of both types are described. The genesis process is discussed in detail. Recommended test procedures and descriptions of modified or nonstandard tests are provided. The results of stabilization studies are reported for both lateritic soils and tropical black clays. A pavement condition survey was carried out which resulted in an evaluation of material specifications and provided a basis for roadway design incorporating the most significant parameters. Design procedures are also included for roads over black clays which facilitate the construction of adequate roads by minimizing volume change or swelling to tolerable limits. A companion usage manual, PB–207 618, is described elsewhere in this issue.

STRESS ANALYSIS OF MULTICOMPONENT STRUCTURES

Naval Civil Engineering Laboratory. S. B. Nosseir, S. K. Takahashi, and J. E. Crawford. October 1971. 38 pages.

AD–733 659

When neighboring components in a multicomponent construction are not monolithically attached, slippage and separation are possible at the contact boundary. Pavement joints, and hatch-covered structures exemplify this type of construction. The document notes several analytical approaches to the phenomenon, and presents the extension of an axisymmetric plane stress method. It uses a finite element computer program to cover the analysis of two-dimensional or axisymmetric elastic structures with slippage along and separation at boundaries of components in contact. The scope is limited to contact boundaries with no shear or tension resistance. Experimental data are used from two photoelastic models representing a pavement joint and a hatch cover. Equations of constraint are given to represent the kinematical conditions of the system. By means of Lagrangian multipliers, the total potential energy expression is modified to account for these constraints. A computer model is used acceptably to simulate the response of the multicomponent structures in slippage and separation.

SHORT CUTS IN CREEP BUCKLING ANALYSIS

Stanford University. Nicholas J. Hoff, and Ilam M. Levi. June 1971. 27 pages.

AD–734 792

Many theoretical analyses of creep buckling have been published in the last few years on the basis of the assumption that the deformations of the thin or slender structural elements are due exclusively to secondary, or steady, creep. In reality all these elements are capable of deforming elastically at the same time when they creep, and often the creep deformations of the material are due to primary creep rather than to secondary creep. It is shown in this paper that in many cases of practical importance it is permissible to carry out the major portion of the analytical work on the basis of the assumption that the deformations are due exclusively to secondary creep, and to apply corrections for elasticity and primary creep only as the last phase of the treatment of the problem. The correction proposed for primary (rather than secondary, or steady) creep is rigorous; it does not involve any approximation. The applicability of the correction factor is extended to thin-walled structures of all kinds. The conditions are given under which use of the factor does not introduce any inaccuracies in the analysis beyond those already inherent in the analysis of the creep buckling of the structure in the presence of steady creep.

STRENGTH FORMULAS FOR DESIGN OF STEEL PLATE GIRDERS

Lehigh University, Fritz Engineering Laboratory. Alexis Ostapenko, Chingmiin Chern, and Siamak Parsanejad. January 1971. 52 pages.

PB–206 660

The design of plate girders for building construction involves the factor of safety against buckling. It has been found from girder buckling tests, however, that the relationship between yielding and buckling strengths is not proportional, so that a constant safety factor for buckling is not applicable to the ultimate strength. The document is concerned with the design of unsymmetrical plate girders with regard to post buckling strength, leading to determination of yielding strength. Design formulas are presented for evaluating the ultimate strength of plate girder panels under bending, shear, or both, the formulas being evolved from a study of numerical data obtained by methods established in the present research. The study is aimed to provide better tools for web design of unsymmetrical plate girders. A tentative recommendation is made for precluding the development of fatigue cracks due to the back-and-forth deflection of the web plate.

Transportation

DEVELOPING AREA TRANSPORTATION SYSTEM STUDY. PROGRAM FORMULATION

Systems Associates, Incorporated. S. Lampert, W. C. Ramsay, and C. R. Walli. February 1968. 167 pages.

AD–673 432

This study is concerned with the planning of transportation systems for developing areas, taking into account those factors involved with social-economic development and security needs. The approach taken involves three parts. The first is concerned with the gross layout of the transportation network based on requirements involving regional growth. The second part is concerned with those elements involved with the mechanization (i.e., types of roads, vehicles, and costs) of the network and the development of the mathematical models that would be employed. The third stage involves the synthesis of the preceding into a representative simulation model descriptive of the transportation system. Such a simulation model is described in the report. Although the study is restricted primarily to surface transport modes and to conditions involving specific regions, the rationale developed may be extended to encompass the more general problem including all modes of transportation and more complex inter-regional networks.

URBAN MASS TRANSPORTATION: BIBLIOGRAPHIC LIST NUMBER 6

Department of Transportation, Office of Administrative Operations. Dawn E. Willis. September 1971. 145 pages.

AD–733 773

The bibliography provides an annotated listing of selected urban mass transportation references to bibliographies, conference proceedings, books, research reports, and periodical articles for the period 1960 through June 1971, plus some pertinent articles prior to 1960. Some of the topics covered are systems synthesis and analysis, information systems, air travel and associated ground transportation, downtown to suburban planning, regional planning and workshops, rapid transit studies, automated systems, human factors engineering, data acquisition and analysis, quality control, development in specific metropolitan centers, bus and rail systems, guidelines, moving walkways, cost engineering, rapid transit modes, routing, control systems, fare considerations, computer methods, gravity-vacuum and other advanced systems, operator training and selection, public relations, management methods, highway transport, rolling stock, transportation theory, financing, and allied subjects.

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GROUND-CRAWLING: 1966: THE STATE-OF-THE-ART OF DESIGNING OFF-ROAD VEHICLES

Wilson, Nuttall, Raimond Engineers Incorporated. C. J. Nuttall, Jr. May 1967. 330 pages.

AD–816 577

From the outset of automotive engineering there has been need and continuing search for a vehicle capable of reliable operation in areas without roads, particularly over uneven, jagged, or soft terrain. The document presents a state-of-the-art survey of ground-crawling vehicles. A historical review is made of experimental configurations of tracked and unconventionally wheeled designs, leading to advanced concepts in tires, treads, and articulated bodies. Both commercial and military requirements are considered. The design process is discussed under the headings of action systems, response, mobility versus loading, weight, costs, reliability, and maintenance. The relative merits of wheels versus tracks are considered in relation to soft ground and boulder-strewn localities. Considerable data are presented graphically, and photographs and drawings illustrate some of the principles investigated, theorized, and recommended. The criterion of performance is foremost. Some testing considerations are included.

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AERONAUTICS AND AIR TRAFFIC CONTROL

Litchford Systems. G. B. Litchford. August 1971. 201 pages.

N71–34025

The study that is discussed in this report examines the environment of the modern aircraft so that the full meaning of "aeronautics" is appreciated. In particular, an evaluation is made of the broad aspects of Air Traffic Control (ATC) and its relationship to the future of aeronautics. Present ATC techniques of controlling air traffic primarily by ground personnel are compared with new concepts wherein the pilot becomes a more active participant in the air traffic control process. The new concepts offer potential for much greater system capacities to cope with the existing and rapidly growing air traffic problems. Additional goals besides increased capacity are: (1) more services at lower costs; (2) ATC services that are more equitable available to all airspace users; and (3) services more suited to a wide spectrum of environments.

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MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES.
VOLUME I: SUMMARY

Rand Corporation. F. S. Pardee, Charles T. Phillips, and Keith V. Smith. August 1970. 56 pages.

N71–34245

MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES.
VOLUME II: METHODOLOGY

Rand Corporation. F. S. Pardee, Charles T. Phillips, and Keith V. Smith. August 1970. 137 pages.

N71–34246

MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES.
VOLUME III: EXAMPLE

Rand Corporation. F. S. Pardee, Charles T. Phillips, and Keith V. Smith. August 1970. 148 pages.

N71–34247

The purpose of the research reported in these volumes is to develop and demonstrate a methodology for evaluation of alternative plans for the future transportation in a region. Evaluation is one of the important functions of most transportation planning agencies. This function is a difficult one because of the large number of dimensions that should be measured and incorporated into the evaluation process. The methodology concentrates on analyzing potential benefits or effectiveness, as opposed to the cost, of alternative transportation proposals or plans. It emphasizes analyzing the impact over time of complete mixes of modes rather than single transportation systems. Further, since the scope of the plans is regional, the emphasis is on intercity travel. The various facets of the methodology developed during the research are presented in detail in Volume II. Volume III illustrates the application of the methodology, using a geographical region that is part of the

Northeast Corridor of the United States as a setting. The contents of these two volumes, together with the results of a previous phase of the research, are summarized in Volume I.

NEW DEVELOPMENTS IN TRANSPORTATION ANALYSIS: EVALUATION OF MIXES OF MODES IN ALTERNATIVE REGIONAL ENVIRONMENTS

Rand Corporation. F. S. Pardee. July 1970. 29 pages.

N71–37592

The report illustrates the application of recent methodological research on the analysis of alternative possible transportation investments. The primary focus was on measuring incremental benefits to be derived from changing the current mix of modes available to provide transportation service to a region. Emphasis is placed on a systematic and comprehensive approach to identification, definition, and measurement of individual sub-benefits which accrue to users of the transportation system, to its operators, or to society in general. A methodology was developed which is capable of assessing overall region-wide effects and to identify these by type of benefit, by group of persons affected, by transportation mode, by access or line-haul link in a region-wide network, and by time period of impact.

A SURVEY OF ENVIRONMENTAL CONDITIONS INCIDENT TO THE TRANSPORTATION OF MATERIALS

General American Transportation Corporation. Fred E. Ostrem, and Basil Libovicz. October 1971. 225 pages.

PB–204 442

This document is a compilation and analysis of the physical parameters of the transportation environment incident to the transportation of materials. Its primary purpose is to provide data for container performance standards, especially with respect to the transportation of hazardous materials. The parameters considered include the conditions of heat, cold, shock, vibration, abrasion, compression, impact, puncture, pressure, and moisture for all elements of the transportation cycle (in transit, handling, and storage).

TRANSPORTATION SYSTEMS TECHNOLOGY: A TWENTY- YEAR OUTLOOK

Transportation Systems Center. George Kovatch, John B. Barber, Robert F. Casey, and George Zames. August 1971. 194 pages.

PB–204 800

This report documents the findings of a technology survey made of various new transportation systems, an analysis performed on some associated critical questions, and a forecast of possible future developments. It is written in a generally non-technical form, with highlights of future possibilities given where appropriate. Emphasis is placed first on urban passenger transportation followed next by interurban short haul passenger transportation. Goods movement is treated only in a cursory manner.

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1971 WORLD SURVEY OF CURRENT RESEARCH AND DEVELOPMENT ON ROADS AND ROAD TRANSPORT. A REPORT COVERING AN INVENTORY OF 63 COUNTRIES

Federal Highway Administration, International Road Federation. December 1971. 458 pages.

PB–206 728

Since 1964 a cooperative effort has been devoted to an international survey and exchange of information on current highway research and development activities on roads and road transport in almost every part of the world. Yearly summary reports began in 1966. The report for 1971 brings up to date and extends the information in previous reports. Six new countries in the world survey have been added to those represented in the 1970 volume. In addition to general coverage of traffic, safety, construction materials, road surface characteristics, vehicle performance, foundations, soils, and allied topics, in depth treatment to environmental considerations in highway location and design, rapid methods of testing road materials and roads, and the delineation of the carriageway edge in rural areas. The 1970 survey, PB–197 492, is described in the April 1972 issue of AMTID, page 110.

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OPPORTUNITIES FOR COST REDUCTION IN THE DESIGN OF TRANSPORT FACILITIES FOR DEVELOPING REGIONS

Institute of Transportation and Traffic Engineering. December 1970. 390 pages.

PB–207 520

The document provides the results of an examination of traditional designs of transport facilities in the developing countries with a view to reducing total initial and/or operating costs, or to reducing costs devoted to the imported elements. The topics include: Road cost analysis and design standards; road construction cost savings in highway engineering design; economics of one-way bridging; potential cost savings in the design of water crossings; potential cost savings in the design and use of ground vehicles; opportunities for cost reductions in aircraft, airways, and airports; potential cost-savings in the selection of waterway and harbor techniques; harbors and associated facilities; economic models for choice of transport techniques in developing countries; tradeoffs between construction costs and maintenance costs. The document is a somewhat revised version of a report previously issued in three volumes, PB–195 597, PB–195 598, and PB–198 035 (see AMTID, April 1972, pages 109 and 111).

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PREPARATION AND APPRAISAL OF TRANSPORT PROJECTS

Department of Transportation, Office of Technical Assistance. June 1968. 107 pages.

PB–207 862

This report, which has been drawn largely from existing economic and engineering knowledge, is organized to provide a convenient guide for those directly responsible for making transport investment decisions in the less developed countries. A central theme is that the value of transportation is measured by the degree to which it contributes to goals in other sectors of the economy, and that sound investment analysis requires a greater awareness of the interrelationships between transportation and the other sectors it serves. Specific topics include: Specifying the transport problem and identifying alternative courses of action; The design of a transport study; Analysis of present and potential traffic; Capacity of an existing transport system; Estimating benefits from transport investments; Appraisal of costs and determination of alternative technical solutions; Decision criteria for choosing among alternative investment possibilities.

Water Supplies and Hydrology

ECONOMIC BASIS FOR WATER RESOURCES ANALYSIS

Rutgers—The State University, Water Resources Research Institute. William Whipple Jr. June 1968. 126 pages.

PB–203 346

The many deficiencies in water resources decision making urgently call for improved principles and methodology of water resources planning, but the numerous critics of current procedures have not agreed among themselves. The objectve of the report is to present a completely integrated economic approach to water resource analysis, which is applicable to all of the major programs involved, and which is in form directly applicable to problem solving. The specific topics covered include: A quantitative utility function of uncertainty; government rate of discount and opportunity costs; economics of flood control; economics of water pollution control; and valuation of cost of private alternatives and public-private optimizations.

AUTOMATIC DOWNSTREAM CONTROL SYSTEMS FOR IRRIGATION CANALS

University of California, Hydraulic Engineering Laboratory. Michael J. Shand. August 1971. 164 pages.

PB–203 672

The basic action of a downstream control system is well suited to irrigation canals. Such a control system on an irrigation canal will respond to a turnout diversion by sequentially adjusting the check gates upstream. The amounts by which the gates are adjusted will be sufficient to meet the required changes in control. An approximate model of a canal reach with such a control is presented. With the model, parameters for the appropriate controllers can be selected so that a controlled reach will be stable, and that no amplification of surges will occur in the upstream reaches.

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POTENTIAL TECHNOLOGICAL ADVANCES AND THEIR IMPACT ON ANTICIPATED WATER REQUIREMENTS

National Academy of Sciences, Committee on Technologies and Water. June 1971. 249 pages.

PB-204 053

The report evaluates potential technological advances and their effect on water supply and demand in the future. These advances are considered in terms of possibilities, rather than as predictions of events most likely to happen. It presents a directory of concepts to increase or decrease future water demand, to increase usable supplies, and to extend usefulness of impure water. A chronological estimation of the likelihood and operational utility of new technologies is included. Consideration is given to six non-technical concepts which may have an impact on the direction of future technological effort. In four scenarios of possible futures, technological concepts are applied to food production, electric power generation, urban water supply and municipal waste disposal, with identification of political, social and economic factors. The report indicates research priorities and ways in which technological change should be given greater emphasis in water planning. A bibliography of related works is included.

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MATHEMATICAL MODELING OF WATER DISTRIBUTION SYSTEMS

General Electric Company. Harold D. Gilman, Maurice Y. Goodman, and Renette V. Metkowiski. July 1971. 243 pages.

PB-204 116

The major objective of the research reported in this document was to develop a model suitable for simulation and study of real-time control of typical water distribution systems and eventual implementation in a process control computer. A unique approach was developed using an "inverse solution" to track flow conditions in the field using a limited number of pressure and flow measurements. It uses a network model to iteratively adjust pipe flows to force agreement between calculated and measured pressures; total demand for the model is fixed by the measured pump and tank flows. The model is then used to simulate and evaluate the application of various control alternatives. A demonstration test case was run showing how this approach can be used to control pressure by turning available pumps on/off. The study also included a literature survey, convergence acceleration methods for calculating a network balance, sensitivity of the "inverse solution" to model data uncertainties, and a compilation of guidelines for water distribution control. IBM 360 Fortran IV source program listings, sample test cases and instructions for using the program are included.

PROCEEDINGS OF THE LAND SPREADING CONFERENCE AT ORLANDO, FLORIDA, ON JULY 15, 1971

East Central Florida Regional Planning Council. July 1971. 137 pages.

PB–204 176

This publication is a compilation of papers presented at a conference on the applicability of spray irrigation as a method of sewage effluent disposal. The subjects of the papers include the following: Basic principles of advanced waste treatment; soil suitability for spray irrigation; hydrogeological considerations in land spreading of sewage treatment-plant effluent; plants and wastewater renovation; renovating sewage effluent by groundwater recharge; engineering design criteria for spray irrigation; actual spray field operations.

SYSTEMS ANALYSIS IN WATER RESOURCES PLANNING

Meta Systems, Incorporated. Russell J. deLucia, Harold A. Thomas Jr., Peter P. Rogers, et al. July 1971. 408 pages.

PB–204 374

This report has a two-fold objective: (1) The examination of systems analysis in water and related land resources planning to describe the potential role of this approach for water resource planners rather than for professionals in operations research; and (2) the recommendation of the uses of systems analysis water resource planning, its promotion in this field, further research needs, and policy considerations. A series of discussions are provided that consider a number of the major issues relating systems analysis and water resource planning. In the course of these discussions, the systems approach is described and its limitations are indicated. Recommendations and comments are made both in the context of specific problems and with respect to general principles.

A CRITICAL REVIEW OF CURRENTLY AVAILABLE HYDROLOGIC MODELS FOR ANALYSIS OF URBAN STORMWATER RUNOFF

Hydrocomp International, Incorporated. Ray K. Linsley. August 1971. 91 pages.

PB–204 815

Hydrology is in a period of transition brought about by the advent of the digital computer. This new computational tool has made possible the development of complex simulation models during the decade of the 1960's. These models involve an "order of magnitude" change in hydrologic methodology. Where the customary working interval had been the day, it is now the hour (or even less). The literature probably contains descriptions of more than 100 "runoff models". Few of these have been specifically advanced as "urban runoff models". Most of these models are easily classified into a few basic types and many differ little from conventional hydrologic techniques of the past few decades. In this report, a review and assessment is given of the basic methodology employed in most models as a preliminary to the description of specific models. A critique is then given of these models as tools for urban hydrologic analysis. In the light of the shortcomings of available models, suggestions are made for future research work in the area of urban runoff simulation. Limited data have always been a problem of urban runoff studies. Few cities measure streamflow, and fewer yet collect auxiliary data necessary for research. Hence, testing of simulation models on urban situations is difficult. Data requirements for the testing and development of improved techniques for urban stormflow simulation are discussed.

CHARACTERISTICS AND POLLUTION PROBLEMS OF IRRIGATION RETURN FLOW

Utah State University Foundation. May 1969. 250 pages.

PB–204 817

This report represents an extensive review of the state of scientific knowledge and technology regarding water pollution problems associated with the practice of irrigation and occurring in irrigation return flow. In irrigation, pure water is extracted by the plants from the water supply, resulting in an inevitable concentration of those dissolved solids which are characteristics of all natural water supplies. Other uses add something to the water, but irrigation basically takes some of the water away, concentrating the residual salts. Irrigation may also add substances by leaching natural salts or other materials from the soil or washing them from the surface. Irrigation return flow is a process by which the concentrated salts and other substances are conveyed from agricultural lands to the common stream or the underground water supply. This study is concerned primarily with the physical and chemical processes as they are now understood, with possible ways to alleviate detrimental effects, and with economic and legal aspects of the problem.

AGRICULTURAL UTILIZATION OF SEWAGE EFFLUENT AND SLUDGE. AN ANNOTATED BIBLIOGRAPHY

Robert S. Kerr Water Research Program. James P. Law, Jr. January 1968, 92 pages.

PB-205 028

Using sewage effluents for agricultural purposes achieves two primary objectives: (1) it makes use of water that is normally wasted and (2) it decreases the pollutant load on the receiving stream and preserves the normal stream flow for beneficial uses downstream. However, comparatively few instances of agricultural use of waste water in crop production have been recorded. More often, the purpose has been the convenient disposal of waste water rather than its maximum utilization. Agriculturists may be overlooking a valuable water source that could be used much more efficiently than is presently being done. Interestingly, the bulk of the literature covering agricultural use of reclaimed waste waters comes not from agricultural scientists, but from those working in the sewage disposal field. A primary purpose of this report is to bring many of these references together hopefully to stimulate interest among crop and soil scientists in the use of sewage effluents that are presently being wasted to surface streams. The 300 abstracts that comprise the report are grouped under the following headings: sewage effluent as an agricultural water resource; agricultural value of sewage sludge; land disposal of liquid wastes; sanitary aspects of waste water utilization; and industrial, recreational, and other water reuse applications.

CENTRO SYMPOSIUM ON HYDROLOGY AND WATER RESOURCES

Central Treaty Organization. February 1966. 485 pages.

PB-206 539

This document presents the papers delivered at a symposium on hydrology and water resources development held in Ankara, Turkey, 2-12 February 1966. It is felt that the meeting marked a step forward in considering the extent and need to develop knowledge of a region's water resources as a vital foundation for economic development programs. The general topics covered include water resources development, surface hydrology, groundwater hydrology, and agricultural and industrial problems.

CENTO SEMINAR ON EVALUATION OF WATER RESOURCES WITH SCARCE DATA

Central Treaty Organization. January 1970. 502 pages.

PB-206 701

As water resources become progressively more difficult to obtain or to control, so the information on which more precise calculations can be made becomes vital to the necessary development.

Since hydrology is one of the basic sciences, there will always be some scarcity of basic information, no matter how much effort is devoted to the subject. The report is comprised of papers, originally presented at a seminar held 4-8 March 1969 in Tehran, Iran, which deal with the evaluation of water resources within the limitations imposed by this scarcity of data. Some of the topics covered are: Minimal data gathering procedures; Maximum utilization of scarce data in hydrological design; Preparation of long term flow sequence from short term records; Drought frequency analysis by means of synthetic flow sequences; Estimation of factors controlling streamflow in areas of limited data; Land treatment in agricultural watershed hydrology research.

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A MODULAR DISTRIBUTED MODEL OF CATCHMENT DYNAMICS

Massachusetts Institute of Technology. Brendan M. Harley, Frank E. Perkins, and Peter S. Eagleson. December 1970. 535 pages.

PB–206 955

The primary objective of the research was to develop and evaluate new techniques for the prediction of the entire hydrograph of surface runoff of an arbitrary drainage basin from the known time distribution of rainfall excess. Utilization is expected to be applicable to both urban and rural areas. The problem of representing complex surface geometry by either a physical or a mathematical model is considered, leading to the choice of a network of simple elements. The study develops thereby a general purpose river basin distributed simulation model. Two methods of flood routing are used: a simple non-linear kinematic wave model, and a complex linear solution to the full equation of motion. A problem orientated programming language suitable for computerized simulation is developed on a time sharing basis.

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EXTENDING UTILITY OF NON-URBAN WATER SUPPLIES

Utah State University Foundation. J. M. Bagley, B. H. Anderson, J. C. Anderson, et al. February 1972. 254 pages.

PB–207 115

Extending the utility of an existing water supply in any given river basin suggests a management-planning approach under three general guiding principles: (1) Minimize depletions wherever possible; (2) generally preserve, protect, and improve water quality; and (3) make carefully considered allocations. There are many technological and managerial techniques that can be employed to implement these principles. This report provides a detailed examination of the concept of "extending utility" of water in a given hydrologic complex. It considers the conditions for achieving greater utility in both a physical and socio-economic sense, and discusses some of the things that might lead to better utilization from a regional or public perspective.

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REPORT BY THE STUDY GROUP ON ANIMAL DISEASES IN AFRICA

National Academy of Sciences—National Research Council. December 1965, 68 pages.

PB–203 361–U

This report presents an evaluation of the most significant aspects of the animal-health, livestock-development, range-management, livestock-marketing, and educational-development programs in the West African region. Several diseases, principally rinderpest, trypanosomiasis, and contagious bovine pleuropneumonia are of immediate concern to these programs. The various sections of the report deal with: Activities of agencies and organizations involved in livestock production, animal health, and veterinary training in countries in West Africa; existing disease control programs; human and technological factors influencing production and marketing; and manpower and education.

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AGRICULTURAL RESEARCH PRIORITIES FOR ECONOMIC DEVELOPMENT IN AFRICA. THE ABIDJAN CONFERENCE 1968. VOLUME I, REPORT OF THE CONFERENCE

National Academy of Sciences—National Research Council. April 1968. 151 pages.

PB–203 367–U

The Conference on Agricultural Research Priorities for Economic Development in Africa, which was held in Abidjan, Ivory Coast, 5-12 April 1968, brought together scientists in similar fields from adjacent countries to address themselves to the problems of filling the agricultural research gap which has been created since the attainment of independence, and of raising the level and scope of activities to meet the growing needs of their countries. This document is comprised of a summary of the conference activities, texts of special addresses, and reports of the plenary sessions and commissions.

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AGRICULTURAL RESEARCH PRIORITIES FOR ECONOMIC DEVELOPMENT IN AFRICA. THE ABIDJAN CONFERENCE 1968. VOLUME II

National Academy of Sciences—National Research Council. April 1968. 481 pages.

PB–203 368–U

This volume is comprised of papers presented at the Conference on Agricultural Research Priorities for Economic Development in Africa, held at Abidjan, Ivory Coast, April 5-12, 1968. Topics covered include: Soil and water management; cereal production; crop protection; grain legumes; cotton; root crops; tree crops; and fruit.

CENTO TRAVELING SEMINAR ON FARM TOOLS AND IMPLEMENTS

Central Treaty Organization. September 1968. 152 pages.

PB-206 776

A survey was carried out in Pakistan, Iran, and Turkey to help determine what could be done to provide farmers of these countries with better farm tools and more power to help them increase farm production. Major emphasis was laid on the collection of information on tools and implements in current use. In addition, consideration was given to a number of tools and attachments which it was felt should be of wider use than at present. This report was prepared as a result of the survey. It is in the form of a handbook for use by agricultural technicians, extension workers, farmers, students, and producers of farm machinery as an aid in their work to promote practical, usable ideas which apply to their areas.

SEED PROCESSING AND HANDLING

Mississippi State University, Seed Technology Laboratory. C. E. Vaughan, B. R. Gregg, and J. C. DeLouche. January 1968. 103 pages.

PB-206 805

Seeds are processed to remove contaminants, to size-grade for plantability, to remove damaged or deteriorated seed, and to apply seed treatment materials. This handbook was prepared as an introduction to seed processing and handling. Various types of equipment are considered. The main features and component parts, principles of separation, uses, and operational procedures are discussed for each machine. Emphasis is placed on the concept of the "processing line", that is, the combination, proper sequence and arrangement of machines, conveyors, and procedures required for handling and processing seeds.

PERFORMANCE AND ECONOMICS OF USE OF SMALL EQUIPMENT IN TROPICAL MONSOON COUNTRIES: THE CASE OF THE PHILIPPINES

The International Rice Research Institute. Stanley S. Johnson. April 1968. 38 pages.

PB-206 806

Mechanized agriculture is being introduced in the countries of Southeast Asia with varying degrees of success and acceptance. This paper discusses the status of mechanization in one of those countries, the Philippines. It provides the background in which this mechanization is proceeding, and then discusses the types of equipment that are being introduced. The performance data on these machines under Philippine conditions, and the economics of their use, are also presented.

AGRICULTURE EQUIPMENT DEVELOPMENT RESEARCH FOR TROPICAL RICE CULTIVATION. SEMIANNUAL PROGRESS REPORTS NUMBERS 10, 11, 12, AND 13

International Rice Research Institute (Philippines). Amir U. Khan, Fred E. Nichols, and J. Bart Duff. 1971. 225 pages.

PB–207 647

The document deals with efforts toward the design, development, and extension to commercial manufacturers of power-driven equipment suitable for use in the production and processing of rice under tropical conditions. Emphasis has been placed on the development of equipment for use by farmers in the 2- to 10-hectare size category, and which can be fabricated within the countries of the region employing locally available resources and manpower to the maximum extent possible. Some of the equipment which has reached the advanced design or production stage includes a power weeder, a row seeder, a table thresher, a rotary screen grain cleaner, a drum thresher, a small walking tractor, and a manually operated low-life pump. Test and evaluation data are provided for many other field and processing devices, and the results of continuing studies of the economics of mechanization are reported.

Education and Training

CENTO CONFERENCE ON ENGINEERING EDUCATION

Central Treaty Organization. November 1966. 420 pages.

PB–206 541

The document is comprised of papers presented at a conference on engineering education held in Isfahan, Iran, 7-15 November 1966. The purpose of the conference was to take cognizance of the fact that an adequate reservoir of well qualified engineers and technicians is basic to developed and developing industrial economies. Specific areas covered include: The need for engineers and technicians; present systems of engineering education; training of engineering technicians; undergraduate engineering curricula; teaching methods and aids; relations of engineering education with industries and government; professional programs related to a region's needs; graduate engineering education; role of research in engineering education; duties, qualifications and preparation of teachers.

CENTO CONFERENCE ON INDUSTRIAL VOCATIONAL EDUCATION

Central Treaty Organization. April 1969. 188 pages.

PB-206 700

Developing nations must meet ever increasing demands for operatives, skilled and semiskilled craftsmen, technicians, in-plant foremen and supervisors, management personnel, and professional personnel. Extensive vocational education is the obvious answer to these demands. This report provides the texts of most of the papers presented at a conference on the problems of vocational industrial education, which was held in Ramsar, Iran, 23-30 June 1968. Some of the topics covered are: Manpower planning and vocational education; Elements of a coordinated national program; Education and training patterns for developing manpower; Developing effective programs for vocational education and training; Structure and use of advisory committees on vocational education; Programs for preparing teachers; Occupational testing, guidance, counselling, and follow-up.

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SURVEY REPORT ON THE ESTABLISHMENT OF THE KOREA ADVANCED INSTITUTE OF SCIENCE

Agency for International Development. D. Benedict, K. Chung, F. Long, T. Martin, and F. Terman. December 1970. 109 pages.

PB-206 978

The Republic of Korea is becoming an industrialized nation with a rapidly expanding economy and, in recent years, the Korean government has been systematically developing new institutions to support the science-based industries which increasingly characterize this expansion. A law has been promulgated to establish a Korea Advanced Institute of Science (KAIS) for the purpose of providing the nation with superior graduate training in those fields of applied science and engineering of importance to Korean industry. This report presents the views of a survey team that was organized for the purpose of evaluating the concept and feasibility of KAIS and advising the government on how best to implement the concept. The topics covered include: Organization, policies, and operations of KAIS; relations between KAIS and other groups in the scientific and technical community; financial considerations, including desirable foreign assistance; future directions.

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SCIENCE IMPROVEMENT PROJECT

National Science Foundation. 1970. 69 pages.

PB-207 400

The report covers the activities of the Indian Science Improvement Project during the calendar year 1970. The major emphasis is on curriculum development activities. Topics covered include:

Elementary and secondary school science programs; travelling science workshop; College Science Improvement Program; special college/university programs; technical education; binational conferences; teaching aids; participant training.

REPORT OF MANAGEMENT TRAINING SPECIALISTS TEAM

Council for International Progress in Management (USA), Incorporated. Robert C. Dietrick, Louis C. McAnly, and James W. Quigg. December 1964. 57 pages.

PB–207 535

The document summarizes the activities of a management training team which was assigned the responsibility of working with trainers of managers in 15 Productivity Centers in Brazil, of demonstrating improved techniques at the local plant level, of giving consultation and advice to productivity institutions on organization and activities programs, and of giving assistance to other management development institutions in Brazil. The program at each Center consisted of round-table discussions, plant visits, case study solutions, and the use of all other modern techniques to develop a local nucleus of management experts for the expansion and multiplication of Brazilian institutional self-help efforts.

A COMPARISON STUDY FOR EVALUATING PRIMARY SCHOOL SCIENCE IN AFRICA

Education Development Center. Eleanor R. Duckworth. October 1971. 61 pages.

PB–207 625

The African Primary Science Program has been developed in eight different African countries and is currently in the initial stages of implementation in these countries. The program differs from conventional science teaching in that it attempts to provide an opportunity for children to know the world on their own terms. Its goals are to equip children with the basis for having their own ideas of interesting ways to use materials that are available to them, of having interesting questions to ask about things, and of ways to go about answering their questions. This report provides an evaluation of the program. In the process, it describes an evaluation methodology which involves the observation of various aspects of children's activity, alone and in groups, in a manner which is conducive to an understanding of what is actually happening.

BEGINNING SCIENCE CURRICULUM FOR ENGLISH SPEAKING TROPICAL AFRICA (AFRICAN PRIMARY SCIENCE PROGRAM)

Education Development Center. December 1971. 126 pages.

PB-207 628

The African Primary Science Program, which was established in 1960 as part of the African Education Program, has operated widely in English-speaking African countries. Science centers have been established with program assistance in seven of these: Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Tanzania, Uganda. Its goals have been centered on changes in pedagogy, but it has also sought to influence the role of education in developing countries. This report records and documents the Program's development, its changing structure, and its efforts to respond to the needs of the countries involved and developing African initiative.

AFGHAN INSTITUTE OF TECHNOLOGY

Daniel, Mann, Johnson, and Mendenhall. September 1968. 383 pages.

PB-207 650

The document is a chronological report of the supervision and inspection of the construction of the Afghan Institute of Technology, Kabul. It covers the construction work itself, materials used, equipment installed, and financial considerations.

Fisheries and Aquaculture

FISH PLANT SANITATION AND CLEANING PROCEDURES

University of Alaska. John P. Doyle. 1971. 13 pages.

COM-71-01091

As in other food industries, there is an increasing awareness of the need for quality control, including better sanitation practices, in the fishing industry. This bulletin provides information on detergents and sanitizing or sterilizing agents useful in fish plants. The most frequently used sanitizing agents are chlorine and hypochlorite compounds; the advantages and disadvantages of these agents are given in detail. Also, guidelines are presented for cleanup crews, a periodic cleaning schedule, and personal hygiene in the plant.

THE POTENTIAL FOR FISHERY DEVELOPMENT IN THE CARIBBEAN AND ADJACENT SEAS

University of Rhode Island, International Center for Marine Resource Development. Clarence P. Idyll. March 1971. 17 pages.

COM-71-50584

The population density in some countries of the Caribbean is among the highest in the world. Food is therefore a problem, and this is made more difficult by the fact that the soil on many of the islands is not especially productive, and that a substantial proportion of the region is mountainous and unsuitable for growing food plants, and even more unsuitable for raising animals. The Caribbean people are relatively large consumers of fish and spend an important part of their scarce foreign exchange to buy fish from other nations. Under these circumstances it is natural that great interest is evinced in the possibility of increasing the supply of animal protein from the sea in the form of fish and other seafoods. The enormous water areas seem to promise vast quantities of fish, and it appears unnecessary that substantial proportions of the supplies of seafood should be imported. The examination which is the subject of this paper was therefore undertaken in an effort to determine the region's potential to produce greater supplies from the sea. Political, social, and economic factors are considered, since these determine whether whatever fish is available can be transported, marketed, and purchased by the people of this area.

FISHCULTURE SURVEY REPORT FOR ECUADOR

Auburn University. H. S. Swingle, and F. A. Pagan. December 1969. 51 pages.

PB–195 907

FISHCULTURE SURVEY REPORT FOR COLOMBIA

Auburn University. H. S. Swingle, and F. A. Pagan. January 1970. 69 pages.

PB–195 908

FISHCULTURE SURVEY REPORT FOR PARAGUAY

Auburn University. R. O. Smitherman, and D. D. Moss. September 1970. 44 pages.

PB–195 910

FISHCULTURE SURVEY REPORT FOR PANAMA

Auburn University. R. O. Smitherton, and D. D. Moss. September 1970. 71 pages.

PB–195 912

FISHCULTURE SURVEY REPORT FOR PERU

Auburn University. R. O. Smitherman, and D. D. Moss. September 1970. 50 pages.

PB–196 355

These reports represent the findings of a series of surveys of the status of and prospects for the fishculture industry in five Latin American countries. The reports include data on geography, nutrition, existing fisheries, fisheries management agencies, research, training programs, and seafood processing activities. The

Paraguay report emphasizes the potential of its sport fishery for increasing tourism. Numerous recommendations are made for the purpose of more fully realizing the fishculture potential in each country.

PHILIPPINES—U.S. WORKSHOP ON FISHERIES AND OCEANOGRAPHY

U.S. National Academy of Sciences—National Research Council, and National Science Development Board—National Research Council of the Philippines. December 1967. 153 pages.

PB-203 365-U

The Philippines—U.S. Workshop on Fisheries and Oceanography, held in Manila in December 1967, had as its principal aim accelerated production of food from the sea for the people of the Republic of the Philippines. This report summarizes the activities, findings, and recommendations of the workshop. Included are reports and position papers of working groups on production technology, research fisheries aquiculture, new products, oceanography, inventory of marine resources, and economic and social factors.

FISHCULTURE SURVEY REPORT FOR WEST CENTRAL AFRICA

Auburn University, Agricultural Experiment Station. D. D. Moss, G. B. Pardue, and M. J. Danner. June 1969. 125 pages.

PB-206 977

Intensive fishculture is an effective means of producing protein of high quality. In view of this, a survey was made of the status and needs of fishculture activities in the following West Central African nations: Cameroun, Central African Republic, Ghana, Ivory Coast, Nigeria, Senegal, and Togo. Attention was given to existing programs being carried out in inland fisheries, with emphasis on fishculture projects, and to the marketing and economics of the fisheries in each country. The requirements for the establishment of fishculture research facilities under conditions prevailing in the various countries were also determined.

Food Technology

APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY, A TECHNOLOGY TRANSFER PROFILE: FOOD TECHNOLOGY

Abt Associates Incorporated. Donald M. Murray. September 1971. 56 pages.

N72-13071

Recently, particularly during the last 20 years, a new technology has been developed in the food industry through which many foods need not be purchased fresh but are available in preserved form. A trend has arisen in which consumers have increasingly used convenience foods produced by special methods of canning, freezing, dehydration, freeze drying, and preserving by additives. Nutritionists, however, have begun to question the effects of additives and preserving techniques on the nutritional value of food, as well as possible hazards to health. The document discusses some of these questions and problems with respect to industrial standards, food contamination, processing methods, packaging, and nutrition. Attention is devoted to the use of edible coatings, freeze dried compressed food bars such as those originally developed for space flight crews, and liquid diets. Especial consideration is given to the processing of meats and to the detection of defrosted and refrozen items.

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THE ECONOMICS OF FISH PROTEIN CONCENTRATE

Massachusetts Institute of Technology. A. H. Keil, et al. September 1970. 202 pages.

PB–195 226

Fish protein concentrate (FPC) may be regarded as any stable powder resulting from the removal of water and oil from fish which is aimed at human consumption. This report examines the economic feasibility of FPC in two disparate contexts: (1) as a nutritional supplement in a diet of a developing country; and (2) as a competitive food additive in a developed country. A review is made of the dimensions of the world protein situation, and consideration is given to the possibility of applying cost benefit analysis to investment in protein supplement programs. FPC and its alternatives are compared for nutritional effectiveness. A discussion is provided of some technical problems in evaluating costs associated with balance of payments considerations, unemployment, and the opportunity cost of capital. Cost and demand data are then developed for the specific case of Chile. The report concludes with a section dealing with the possibility of commercial marketing of FPC in the United States.

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COMMERCIAL FEASIBILITY OF FISH PROTEIN CONCENTRATE IN DEVELOPING COUNTRIES. VOLUME I—THE PROTEIN SITUATION IN KOREA AND THE POTENTIAL ROLE FOR FISH PROTEIN CONCENTRATE

General Oceanology, Incorporated. October 1969. 145 pages.

PB–195 913

This report establishes that protein malnutrition exists in certain target groups in Korea, and that fish protein concentrate (FPC) might contribute to ameliorating the protein shortage. Present economics and raw materials shortages, however, mitigate against a self-priming commercial FPC operation in Korea. Some alternative paths for protein relief via FPC are, however, possible. In the report, the elements of protein nutrition and fortification are first reviewed. The Korean protein system is described, and the "protein gap" is calculated so that the need of nutritionally deprived target groups can be determined. Alternatives are proposed for meeting the Korean protein needs, including the use of FPC. The cost effectiveness of protein fortification is determined. The feasibility of producing FPC locally is examined, and alternatives sought for obtaining supplies of FPC in the future. The implications of a protein supplement program on national nutrition policies are examined, including the possible role of FPC. Finally, the cost of closing the "protein gap" is examined.

A REPORT ON THE LEMBAGA ILMU PENGETAUAM INDONESIA-NATIONAL ACADEMY OF SCIENCES, USA, WORKSHOP ON FOOD HELD AT DJKARTA, INDONESIA, MAY 1968. VOLUME I

U.S. National Academy of Sciences, and Indonesia Academy of Sciences. November 1968. 43 pages.

PB–203 370–U

A REPORT ON THE LEMBAGA ILMU PENGETAUAM INDONESIA-NATIONAL ACADEMY OF SCIENCES, USA, WORKSHOP ON FOOD HELD AT DJKARTA, INDONESIA, MAY 1968. VOLUME II

U.S. National Academy of Sciences, and Indonesia Academy of Sciences. November 1968. 168 pages.

PB–203 371–U

A REPORT ON THE LEMBAGA ILMU PENGETAUAM INDONESIA-NATIONAL ACADEMY OF SCIENCES, USA, WORKSHOP ON FOOD HELD AT DJKARTA, INDONESIA, MAY 1968. VOLUME III

U.S. National Academy of Sciences, and Indonesia Academy of Sciences. November 1968. 126 pages.

PB–203 372–U

A week-long workshop on food was held in Djkarta 27 May-1 June, 1968, to formulate recommendations addressed to Indonesia's most crucial current problem: how to overcome calorie deficiencies and achieve a more nutritious diet for the country's 117 million people. In the selection of subjects recommended for concentrated research, and effort was made to list topics for which the country's scientific and technological resources could be mobilized fully to support the top priority national goal of increased food production. This report was drafted by eight working groups, each of which considered food production from a different aspect. Volume I contains the over-all findings and recommendations of the workshop. Volume II presents the reports of the individual working groups. Volume III includes keynote addresses, a list of participants, and other supporting material.

MODELING THE ECONOMIC DEVELOPMENT OF A POORLY ENDOWED REGION: THE NORTHEAST OF THAILAND

Rand Corporation. John Enos. January 1970. 340 pages.

AD-733 961

This document presents, possibly for the first time, an application of a relatively new method of analysis to a particular underdeveloped economy. The method in question is the simulation model. Previous applications have been to hypothetical economies, making it impossible to test the behavior of the models against reality. The study collects in one work most of the available information of interest on the economy of the northeast of Thailand, and it suggests what additional information is most needed to increase the knowledge of the economy. The model of the economy is simulated, under various economic conditions and with various government policies, on a computer, commencing with the year 1960 and terminating with 1985. The quantitative "histories" that are traced out, one for each set of conditions and policies, are then compared in an effort to determine the likely effects of the alternatives. The implications of the results for the economic future of the provinces of northeastern Thailand are discussed in detail.

VENTURE CAPITAL: A GUIDEBOOK FOR NEW ENTERPRISES

Boston College, The Management Institute. Albert J. Kelley, Frank B. Campanella, and John McKiernan. July 1971. 154 pages.

COM-71-01099

Venture capital is a term applied to the financial backing which established capital sources are willing to extend to a promising entrepreneurial venture, whether it is a new company, an expanding establishment, or a mature organization desirous of revamping. In every case the prospective investors must feel assured that the industrial effort will be a successful one and thereby provide an appropriate return in either money or other development. The document is designated as an entrepreneur's handbook for launching a business enterprise, with the aim of removing some of the mysticism from financing endeavors. It is pointed out that the entrepreneur is seeking partners as well as investors, so that he must select that venture group that can best complement his own objectives. The volume explains how venture capital works, describes the steps the entrepreneur must take before he approaches venture capital sources, and provides information about selected sources and how they wish to be approached.

BOOKS AS TOOLS FOR NATIONAL GROWTH AND DEVELOPMENT

Wolf Management Services. Stanley A. Barnett, Emerson L. Brown, et al. June 1965. 216 pages.

PB-193 156

Books are regarded as an indispensable requirement in the education and training of young people and adults in countries seeking to develop their economic and industrial level. The report presents a generalized case study, highlighting and illustrating the basic facts and problems of the book industry (including educational publishing) in developing countries, in its relation to educational development and to national growth. Specific examples are given from a previous study of the Turkish case. Topics reported include: The book industry in developed countries; summary of the Turkish survey; Turkey and the nature of its book industry; government publishing and the textbook industry; private publishing and other local book producers; the role of imports; the educational book market; other book markets; book industry needs, resources, and capabilities; book-related foreign assistance to Turkey; recommendations for the more effective use of books in Turkey.

ROLE OF REMOTE SENSING IN DEVELOPING COUNTRIES

Agency for International Development, Office of Science and Technology. July 1971. 100 pages.

PB-203 309

Many of the developing countries are genuinely interested in the application of airborne and spaceborne sensing techniques to development problems. This document is comprised of a series of papers which are intended to facilitate understanding of the contributions these remote sensing techniques can make to economic development. The topics covered include: Remote sensing and international development; the utility of resource surveys; selected examples of resource surveys; ground resolution of remote sensing technology; adaptation of U.S. experience to developing country applications; game counting and evaluation by photography.

THE INTERNATIONAL DEVELOPMENT INSTITUTE

National Academy of Sciences, Board on Science and Technology for International Development. July 1971. 67 pages.

PB-203 331

In a message to Congress on 15 September 1970, the President of the United States proposed an International Development Institute as a key element in a reorganized foreign aid program. The activities of such an organization would include: Applying U.S. research competence in the sciences to the problems of development; providing assistance in building and strengthening research institutions in developing countries; helping train manpower in developing countries; and helping finance advisors on development problems. This document constitutes the report of an AD HOC Committee on the International Development Institute. It sets forth a set of ideas that may contribute in the conceptual development, planning, and public justification of the proposed new organization. It also identifies several of the basic difficulties that must be faced, and suggests possible solutions.

REPORT OF THE ARGENTINE-U.S. WORKSHOP ON SCIENCE AND TECHNOLOGY IN ECONOMIC DEVELOPMENT

U.S. National Academy of Sciences; and Argentine National Academy of Exact, Physical and Natural Sciences. August 1969. 84 pages.

PB–203 378–U

This report records the issues discussed and the conclusions reached at the Argentine—U.S. Workshop on Science and Technology in Economic Development held in Mar del Plata, Argentina, 28 July-1 August, 1969. The theme of the meeting was the "Use and Management of Scientific Resources". Special panels considered these major topics: Food technology; groundwater hydrology; scientific information; agricultural research and training, with emphasis on pasture ecology and management; planning the formation of human resources for scientific and technological development, economic aspects, scientific careers and orientation; basic problems in the use of scientific resources for economic development and technology transfer; and relationships among organizations of the scientific-technological complex.

SECOND U.S.-PHILIPPINES WORK ON COOPERATION IN SCIENCE AND TECHNOLOGY

U.S. National Academy of Sciences, and National Science Development Board (Philippines). November 1966. 112 pages.

PB–204 407

The second in a series of science workshops of the Joint U.S.-Philippines Science Cooperation Program was held at Pacific Grove, California, November 6-10, 1966. The workshop delegations consisted of Philippine and American scientists and technologists representing the public and private sectors as well as government officials from the Philippines concerned specifically with science policy questions. Meeting informally as scientists cooperatively investigating problems of mutual concern, they discussed how science and technology might make a more significant impact on economic and social development in the Philippines.

Areas of particular concern were: industrial research and development; food, nutrition and demography; the coconut; mineral resources; energy sources; water sources; oceanography and fisheries; meteorology; water and air pollution. The document contains the session reports, the summary of recommendations for collaborative programs and contributed papers as submitted by the Philippine participants.

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THE AID RESEARCH PROGRAM: PROJECT OBJECTIVES AND RESULTS

Agency for International Development, Bureau for Technical Assistance. March 1971. 132 pages.

PB–206 536

The centrally funded research program of the Agency for International Development was initiated in 1962; since that time 142 research projects in agriculture, health, nutrition, population, education, institutional and social development, industrial and urban development, and economics have been funded. This report provides information on the purposes of each project, a minimum description of the methodology employed, the countries in which the research was conducted, and a statement on the participation of personnel and organizations in other countries. The important findings of each project are summarized, and the known uses of the research products are outlined.

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MANUAL ON BOOK AND LIBRARY ACTIVITIES IN DEVELOPING COUNTRIES

State University of New York, School of Library Science. Stanley A. Barnett, and Roland R. Piggford. June 1969. 247 pages.

PB–206 540

This guideline manual is intended to provide assistance to those interested in conceiving and framing sound and useful book activities for the enhancement of economic development. It is a compendium of ideas, techniques, and procedures regarding book and library activities that have been formulated and/or tested in developing countries during recent years. Specific areas of coverage include: The role of books in the national growth process; summaries of the major book needs in specific developing areas; summary of international book activities by government and private organizations; book subsidy programs and projects; library development activity and training; book and periodical procurement services; stimulating local book industries; regional book development or translation centers; textbook programs; building and strengthening book-related institutions; and financing book industry development.

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DECADE OF DEVELOPMENT: COMPENDIUM OF UNITED STATES-SPONSORED CENTO ECONOMIC PUBLICATIONS. 1959–69

Central Treaty Organization. Mary Margaret Lawrence. 1970. 208 pages.

PB–206 548

The Office of the United States Economic Coordinator for CENTO Affairs has sponsored and financed a large number of conferences, symposia, seminars, and workshops organized to further the social and economic development of the three regional CENTO countries, Iran, Pakistan, and Turkey. In many cases the papers presented at these meetings have been preserved in book form. This document contains a brief summary of the contents of each of these books. The general subject areas covered by the books include: Agriculture; Economics and statistics: Education; Geology and minerals; Hydrology; Public administration; Public health; Science; and Veterinary science. A list of libraries where fairly complete sets of CENTO economic publications are located is included.

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A STUDY OF SELECTED LABORATORIES AND DEPARTMENTS OF THE COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, GOVERNMENT OF INDIA

Battelle Memorial Institute. July 1965. 57 pages.

PB–206 699

Visits were made to representative laboratories of the Council of Scientific and Industrial Research of India in an effort to gain an insight into present policies and attitudes regarding practical applications of research results, the support or lack of it with the industrial sector, the effectiveness of the laboratory in producing results for industry, and constructive steps that might be taken for improvement. This report provides a review of the findings and observations resulting from the visits.

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WORKSHOP ON SCIENCE AND TECHNOLOGY PRIORITIES FOR INTERNATIONAL DEVELOPMENT

Agency for International Development, Office of Science and Technology. December 1971. 177 pages.

PB–206 752

This report includes papers that were prepared at a workshop, held 17-19 December 1971, which was concerned with science and technology priorities in international development. The three broad fields considered at the workshop: Development, adaptation, and diffusion of industrial technologies to fit the particular needs of developing countries; better use of natural resources and improved environmental planning; and development of infrastructure for effective use of science and technology. These fields appear to have important unrealized potentials for the application of U.S. scientific and technological capabilities to help the developing countries make significant development advances.

CENTO SYMPOSIUM ON SCIENTIFIC AND INDUSTRIAL RESEARCH

Central Treaty Organization. November 1964. 250 pages.

PB–206 756

The document is comprised of papers presented at a symposium, held at Lahore, Pakistan, 16-23 November 1964, which was organized with the specific aim of accelerating scientific progress and industrial development in Iran, Pakistan, and Turkey. The subject areas covered include: Present status of scientific and industrial research; project selection, design, and execution; manpower requirements and organization; evaluation of research results.

FIVE INDUSTRIES FOR THE CENTRAL AFRICAN REPUBLIC

Continental-Allied Company, Incorporated. November 1965. 246 pages.

PB–206 775

Isolated by geography, lacking low-cost means of transportation, the Central Africa Republic earns comparatively little from her exports, and pays heavily for her imports. It is considered imperative that the C.A.R. reorient her economy towards manufacture of goods for her own market. In view of this, a survey was made of private investment opportunities in industry and commerce in the C.A.R. Five possible new industries-storage batteries, asbestos cement, starch, reconstituted milk and ice cream, and tomato puree—were selected on the basis of this survey and studied in detail. In each case, it was found that the industry can operate to serve C.A.R.'s internal market, to reduce present prices, and to earn a profit of at least 25% per annum.

REPORT OF SURVEY TEAM: PROJECTED AID RESEARCH PROGRAM ON IMPROVED FOREST PRODUCTS UTILIZATION IN LATIN AMERICA

U.S. Department of Agriculture, Forest Service. A. D. Freas, B. F. Kukachka, and E. F. Landt. August 1965. 66 pages.

PB–206 802

South America has the largest single forested area in the world, most of it inaccessible and remote from population centers and, hence, unused to a great extent. Most of the forest consists of heterogeneous stands with many species that so far have not found their way into the world market or into local utilization. This report presents recommendations for a group of research projects to improve the economic use made of Amazonian and other forest areas of Peru, Brazil, Colombia, Venezuela, and Ecuador. The general nature of the projects are as follows: Research on little-known timber species of Latin America in relation to their utilization locally and abroad; studies on the preparation of high yield pulps; and forest products utilization and marketing in Venezuela.

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COOPERATIVE EFFORT IN INDUSTRIAL DEVELOPMENT

C. W. Robinson and Company, Incorporated. December 1966. 203 pages.

PB–206 803

The Nepal Industrial Development Corporation (NIDC) has the responsibility of coordinating the Nepalese Government's program to mobilize private capital in sound and profitable industrial enterprises. This report summarizes selected activities and achievements that have been of particular significance in the success of the NIDC during the period from July 1962 to December 1966. Among the topics discussed are: Management of NIDC; banking activities; meeting special problems of bank clients; investment promotion; development of human resources; pre-investment studies; industrial districts.

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PROCEEDINGS OF STANFORD CONFERENCE ON A JOINT UNIVERSITY-INDUSTRY PROGRAM TO ASSIST IN THE INDUSTRIAL DEVELOPMENT OF LATIN AMERICA

Stanford University, Institute in Engineering Economics Systems. April 1964. 101 pages.

PB–206 888

A conference was held at Stanford, California, 3-4 April 1964, for the purpose of bringing together U.S industry and university representatives to discuss the problems involved in the development of new industries in the developing regions of Latin America. An effort was also made to formulate a constructive program of action which would, over a period of time, become self-supporting and of mutual benefit to both the U.S. and the developing countries. This report provides a summary of the activities of the conference and the text of the papers presented at it.

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INDUSTRIALIZING AT THE GRASS ROOTS LEVEL IN THE PHILIPPINES

Agency for International Development. Kenneth P. Sheldon. 1963. 63 pages.

PB–206 902

The establishment of a first industry in an underdeveloped region stimulates others into being; a small beginning is enough to set up a chain reaction. This principle has been demonstrated time and again in the Philippines and in other developing countries. The document shows how this start was made in the highly agricultural provinces in the Philippines and the proper way for it to develop. In addition to a general discussion of principles and procedures, the document contains, for the purpose of providing a concrete example, a detailed report of a survey made of a single Philippine province (Tarlac) to obtain practical information concerning its resources, natural advantages, and the desires of its people regarding industrialization.

REPORT ON SURVEY OF BRAZIL CONCERNING THE NEED FOR INDUSTRIAL DEVELOPMENT TRAINING

George Washington University. John A. Brown, and Charles T. Stewart, Jr. October 1964. 69 pages.

PB–206 903

A report is given on the industrial training needs of Brazil based on a survey made in Sao Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Salvador, and Recife. The topics covered include: Regional contrasts with respect to industrial development needs; manpower shortages for industrial development programs; policy issues; long run constraints on industrial development; existing training activities and organizations (including those operated by federations of labor, productivity centers, business firms, and universities); problems of new training programs; approaches toward meeting industrial development needs with respect to training program structure, content, and location.

AN INDUSTRIAL PARK DEVELOPMENT PROGRAM FOR CENTRAL AMERICA

Stanford Research Institute. Keith E. Duke, Phillip L. Adams, and Robert W. Davenport. November 1964. 246 pages.

PB–206 904

The development of a number of industrial parks in Central America could be an important means of stimulating industrial growth and promoting industrial development in this region. This document provides the results of a study undertaken to determine the desirability and feasibility of establishing such industrial parks, and to define the nature, scope, and costs of an industrial parks program. The topics covered include the purposes and characteristics of industrial parks in Central America, the physical infrastructure and its general influence on industrial growth and location of industrial parks in the region, specific proposed locations for industrial park sites, and financial and organizational resources for an industrial parks program.

ECONOMIC DAMAGE CAUSED BY AQUATIC WEEDS (PRELIMINARY SURVEY)

Agency for International Development, Office of Science and Technology. December 1971. 17 pages.

PB–206 905

In recent years there has been a growing concern among developing countries and development agencies about the steady proliferation of aquatic weeds in tropical and subtropical regions. Increasing attention is being given to techniques for controlling the growth of such weeds. This report provides a preliminary estimate of the economic significance of the aquatic weed problem in developing countries. The estimates are presented in an order of magnitude form for selected types of damage caused in specific settings. Consideration is given to the problems of weed infestations in rivers, streams, canals, reservoirs, ponds, lakes, harbors, and similar bodies of water, but not in rice paddies, irrigation ditches, or other agricultural settings.

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PROJECT COLORADO. FEASIBILITY STUDIES—PRELIMINARY DESIGNS

Colorado State University, and University of Bahia. Harry F. Troxell, and Carlos E. de Sa. 1964. 63 pages.

PB–206 913

Project Colorado is a program of cooperation for industrial development in the State of Bahia, Brazil. The objectives, to develop new small, rural industries and to train business and engineering leaders, are accomplished by utilizing faculty and students from the University of Bahia and Colorado State University. The industrial development activities are based on a thorough analysis of the advantages and opportunities the region has to offer. Feasibility studies, followed by preliminary designs, were made for the following industries: Poultry and egg; ceramic products; peanut oil extraction; slaughterhouse for cattle and hogs; mandioca processing; and fruit processing. This document contains detailed reports of each of these industrial prospects by the personnel who contributed to the general evaluation, the marketing data, and the production requirements.

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REPORT ON SMALL INDUSTRY PROGRAMS IN TURKEY

Small Business Administration. Ross D. Davis. February 1965. 41 pages.

PB–206 967

The report sets out observations based on a visit to Turkey made in January 1965 by the Executive Administrator of the U.S. Small Business Administration. The purpose of the visit was to evaluate certain plans of the Government of Turkey designed to modernize small-scale industry, to promote its integration into a balanced pattern of industrial development, and to create in small industry a significant capacity for import substitution and export activities. The topics covered in the report include: Role of small industry in Turkey; planning for small industry; current activities to support small industry; some useful principles to guide the development and operation of small industry programs; comments on the small industry programs in Turkey; an agency for small industry programs.

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CENTRAL AFRICAN INDUSTRIAL COORDINATION SURVEY

Checchi and Company. July 1965. 45 pages.

PB–206 968

The report presents the findings and conclusions of an Industrial Coordination Survey of the Central African sub-region of Cameroun, Central African Republic, Chad, Congo, Democratic Republic of the Congo (Zaire), and Gabon. The principle objective of the study, which was done in association with the Economic Commission for Africa, was to investigate the possibilities for sub-regional harmonization of industrial development. A list of industries that appear to have a market potential in the sub-region was developed, and certain specific industries were considered in detail with respect to coordination. The report also contains a section dealing with entrepreneurship and the encouragement of industrial growth in the sub-region.

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PREFEASIBILITY STUDY OF AN EXPANDED LEATHER AND SHOE INDUSTRY IN WEST AFRICA TO 1980

Battelle Memorial Institute. Konrad Biedermann. July 1966. 57 pages.

PB–206 970

Cooperative economic-development planning on a basis that includes the entire West African sub-region promises to result in an industrial development pattern that might contribute to a more effective and economic utilization of African resources and to improvement in living standards. This requires, however, obtaining an overview of what a feasible industrialization pattern for specific industries within the sub-region might be over a period of 10 to 15 years. An attempt is made, in this report, to answer some of the basic questions along these lines for the leather and shoe industry in West Africa. Consideration is given to West African markets for leather and shoes, current production capabilities, feasible expansion of leather and shoe production to 1980, and the potential importance to economic development of West Africa.

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PREFEASIBILITY STUDY OF AN EXPANDED PAINT PRODUCTS INDUSTRY IN WEST AFRICA TO 1980

Battelle Memorial Institute. Harry W. Barr, Jr. July 1966. 42 pages.

PB–206 971

A study was undertaken to gain an approximation of what a feasible industrialization pattern for the paint products industry in the West African sub-region would appear to be in the period up to 1980. This report provides the results of the study. Consideration is given to current markets for paint products, projected markets to 1980, local production of raw materials and paint products, and potential importance to the economic development of West Africa.

PRE-INVESTMENT STUDY: MEAT PACKING INDUSTRY FOR ENTENTE GUARANTY FUND

Thomas H. Miner and Associates, Incorporated. November 1967. 177 pages.

PB–206 972

Livestock are among the principal resources of the West African Savanna zone, and surplus livestock have, for centuries, supplied some of the consumption needs of the populous Coastal cities many hundreds of miles to the south. It is believed that this traditional livestock trade can be rationalized principally by more slaughterhouses in the producing zone, and subsequent shipment of meat to the consuming areas. This procedure would tend to add more value to the products of the stock raising countries, while providing better and cheaper meat to consumers. Accordingly, an economic and technical analysis was undertaken aimed at inducing U.S. private investment in the livestock industry in Niger and Upper Volta to serve markets in Ivory Coast, Togo, Dahomey, Ghana, Nigeria, and other appropriate markets. Consideration was given to availability of livestock in Niger and Upper Volta, type of existing potential consumer markets, recommended basic plant, interest of governments and/or private interests for possible joint venture, benefits to host countries, and investment and income schedules.

REPORT OF PRIVATE INVESTMENT SURVEY TEAM

Council for International Progress in Management, Incorporated. Orvis J. Fairbanks, and Charles R. Yancey, 1967. 114 pages.

PB–206 973

The report is comprised of the findings of an investment survey of the state of Ceara (Brazil), which was conducted in conjunction with the Companhia do Desenvolvimento do Ceara (CODEC). Economic recommendations are made with respect to transportation, electric power, communications, water, sanitation, irrigation, money and finance, taxation, education and training, agriculture and agro-industry, manufacturing, mining and minerals, and lumber and forestry. The establishment of an economic information center is outlined, and recommendations are made for an analytical and information-gathering system for feasibility studies. In addition, basic information is provided on Ceara for those not familiar with the state.

A CURRENT BLUEPRINT FOR INDUSTRY PLANNING IN BRAZIL

Agency for International Development, Office of Capital Development and Industry, Rio de Janeiro. March 1968. 32 pages.

PB–206 974

The keystone in the economic growth of Brazil is the private sector. All other sectors and factors assume an importance in proportion to the degree to which they enable, facilitate, or enhance the growth of private enterprise. This statement defines the frame of reference in this report for considering the roles played by the existing Brazilian organizations which serve as Centers for Industrial Development. Their effectiveness and shortcomings are evaluated, and the degree to which U.S. practices have been introduced and incorporated or rejected is discussed. Consideration is also given to what Brazilian institutions have done by themselves, and what more needs to be done to help them assist industry.

EXPANDING EXPORTS. A CASE STUDY OF THE KOREAN EXPERIENCE

Agency for International Development. Amicus Most. June 1969. 248 pages.

PB–206 975

The report presents an evaluation of work undertaken to develop a successful export program in Korea. Its purpose is to explain the factors and reasons that led to the success of this export development. A detailed analysis is provided for all facets of export activity in Korea, considering the successes and failures for each component, and making comparisons with similar programs in other developing countries. The analysis suggests general principles and describes specific activities that may be applicable elsewhere in the world.

FEASIBILITY OF IPECAC EXTRACTION PLANT

H. B. Maynard and Company, Incorporated. Eugene H. Payne. April 1966. 45 pages.

PB–207 132

"Brazilian" ipecac is the rhizome and root portions of the low growing vine Cephaelis (Uragoga) Ipecacuanha. It is the source of emetine and several other alkaloids. The report presents the results of a study undertaken to determine the feasibility of establishing facilities to distill ipecac in Bolivia. It was found that such a facility would be economically sound only under one or both of two conditions: (1) that the cultivation of the source plant be encouraged; and (2) that it be operated in conjunction with the extraction of other products, such as cocillana, achiote, and cinchona.

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A REPORT TO THE AGENCY FOR INTERNATIONAL DEVELOPMENT ON A VISIT TO KOREA BY A NBS TEAM UNDER AID SPONSORSHIP

National Bureau of Standards. F. K. Harris, R. K. Eby, and H. S. Peiser. March 1968. 41 pages.

PB–207 392

Because of its lack of a strong base of natural resources, the Republic of Korea must depend on processing and manufacturing for an export market to sustain a viable economy. Thus the problems of quality assurance, particularly for export items, are of paramont importance. It was in connection with these problems, and with the testing programs that implement quality assurance, that visits were made by a team from the National Bureau of Standards to about 50 Korean research, testing, and standards laboratories and government offices. This report provides a review of the visits, together with the conclusions and recommendations of the team.

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THE INSTITUTIONAL DEVELOPMENT AGREEMENT. A NEW OPERATIONAL FRAMEWORK FOR A. I. D. AND THE UNIVERSITIES

National Association of State Universities and Land Grant Colleges. January 1970. 98 pages.

PB–207 393

This is the report of a joint committee of the National Association of State Universities and Land Grant Colleges (NASULGC) and the Agency for International Development (A. I. D.). The committee was asked to consider and recommend measures to improve operating arrangements between A. I. D. and the universities, including possible arrangements for experimental types of A. I. D. grants to universities for overseas technical assistance projects. The committee paid special attention to a type of development activity for which American colleges and universities are especially well suited—the multi-year technical assistance project designed to aid in the establishment or improvement of educational and research institutions in less developed countries.

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VILLAGE TECHNOLOGY HANDBOOK

Volunteers for International Technical Assistance, Incorporated. May 1970. 380 pages.

PB-207 491

Village development takes on special importance in the light of the fact that 80% of those who live in less developed countries live in villages. This handbook is aimed at helping villagers to master the resources available to them: to improve their own lives and to bring their villages more fully into the lives of the nations of which they form a basic part. It describes techniques and devices which can be made by the villagers who will use them. The general topics covered include the following: Developing water resources; water lifting and transport; water storage and water power; water purification; sanitary latrines; bilharziasis control; earth-moving devices for irrigation and road-building; irrigation; poultry raising; silage for dairy cows; storing food at home; storing vegetables and fruit for winter use; how to salt fish; concrete construction; bamboo construction; glues; solar water heater; washing machines; cookers and stoves; home soap making; bedding; crafts and village industry; bamboo and reed writing pens; silk screening; inexpensive rubber cement.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME I. NATURAL RESOURCES. ENERGY. WATER AND RIVER BASIN DEVELOPMENT

Agency for International Development. 1962. 388 pages.

PB-207 495

The document is one of a series containing papers of U.S. origin which were submitted at a conference on the Application of Science and Technology for the Benefit of Less Developed Areas, held in Geneva in February 1963. This volume includes the following papers: Electrical Distribution Grid Design and Construction for Rural Areas; The REA Program and the Role of Rural Electric Cooperatives; TVA's Experience with a Power Utilization Program for Rural Areas; Some Problems in Initiating Power Supply in Less Developed Areas Based on Case Histories; Rural Electrification & Rural Development; Typical Problems in the Development of Modern Power Supply in Less Developed Areas; Practical Application of Coal Mining Technology to Projects in Less Developed Areas; Metallurgical, Domestic, and Industrial Utilization of Low-Rank Coals; Auxiliary Injected Blast Furnace Fuels; Financing Oil Expansion in the Development Decade; Economics and Design of Smaller Petroleum Refineries; Recent Developments in the Design of Small Refineries; Nuclear Power Technology and Costs; Economic Criteria for Evaluating Power Technologies in Less Developed Countries; Energy Cost Comparisons; Techniques for Appraising the Energy Economy and Outlook in Less Developed Countries; New Steps Toward

Better Data and Investigation for Water Resources Development; Community Water Systems in the United States; The Community Water Supply Development Program of the Agency for International Development; Low Cost Waste Treatment—Waste Stabilization Ponds; River Basin Planning in the United States; Advances in Techniques of Ground-Water Resources Development; Exploration for Ground Water, Northeast Thailand, 1952-1962; Hydrology and Scientific Reclamation in the Punjab, West Pakistan; Making Wise Use of Flood Plains; Desalination; Evaporation Reduction; Artificial Precipitation; Large-Scale Weather and Climate Modification; Education in Hydrology.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME II. NATURAL RESOURCES. MINERALS AND MINING. MAPPING AND GEODETIC CONTROL

Agency for International Development. 1962. 364 pages.
PB–208 432

This volume includes the following papers: Government as a dynamic agent in mineral resource development; The role of national geological surveys in mineral resources development; The importance of a central mines bureau in fostering development of mineral resources; Legislative choices in the development of mineral resources; Development, organization and operation of the Instituto de Investigacioners Geologicas of Chile; Opportunities for regional organization in mineral resources development; A cooperative mineral exploration and development program in Pakistan; In-service and university training of geologist and mineral engineers; Development of nonmetallic mineral resources for fertilizers in a dominately agrarian economy;A minimum program for mineral resources evaluation; Integrated mineral exploration; Regional heavy-mineral reconnaissance as a guide to ore deposits in deeply weathered areas with semi-humid to humid, temperate to tropic climate; Successful new techniques in prospecting for phosphate deposits; Stratigraphic research as applied to mineral resources exploration and development in Pakistan; The use of air photographs in the development of a natural resources of Mexico; The application of photogeology and photogrammetry to geological surveys of natural resources in Pakistan; Application of mining technology in the development of mineral resources of less developed countries; Development and mechanization of small mines; Opportunities and problems in beneficiation and extractive metallurgy practices; Education and training for staffing surveying and mapping operations; Maps as a basic requisite for economic development; The importance of geodetic control and the advantages of its new techniques; Modern techniques and instruments for surveys and mapping; Practical considerations for rapid mapping in developing countries; Aerial photo interpretation for the evaluation of vegetation and soil resources; International cooperation in surveying and mapping in the Americas.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME III. AGRICULTURE

Agency for International Development. 1962. 274 pages.

PB–207 496

This volume includes the following papers: Organizing for Agricultural Development; Interactions in Agricultural Development; The Tenure of Farms, Motivation and Productivity; Efficient Use of Labor, Land and Capital for Agricultural Development in Densely Populated Areas; Complementarity Between Agricultural and Industrial Development; Effective Communication in Agricultural Extension; Improving Management in Agricultural Development; Meeting Human Needs Through Agricultural and Food Practice; Changing Dietary and Health Practice; International Cooperation in Nutrition, Research and Planning; The Evolution of Soil Science and Its Application to Human Progress; Transforming Irrigation from an Age-Old Art into a Modern Science Through Research and Technology; Principles of Plant Genetics and Their Use in Increasing Food Production; Contribution of Science to the Understanding and Control of Plant Diseases; Protection from Insect and Vertebrate Pests in Relation to Crop Production; Basic Principles in Weed Control and Their Importance in Crop Protection; Scientific Developments in Pasture and Forage Production; Animal Health and Nutrition; Animal Improvement and Adaptation; Forestry's Contribution to a Permanent Agriculture; Development of Modern Fisheries; Improvement of Production and Preservation Methods in an Underdeveloped Fishery Through Upgrading Fishing Vessels, Gear, and Sanitary Procedures; Ocean Fishery Products and Their Inland Transport in Less Developed Areas.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME IV. INDUSTRIAL DEVELOPMENT

Agency for International Development. 1962. 198 pages.

PB–207 497

This volume includes the following papers: Policy Considerations in Expanding Industrial Development; The Strategy of Industrial Development; Creating a Practical Industrial Development Program; The Provision of Adequate Capital for Industrialization; Planning Management Development in Industrializing Countries; The Place of Small and Medium Industry in Development; Markets as a Basis for Industrial Development; Integrated River-Basin Development and Industrialization: The Tennessee Valley Experience; The Industrial Estate—Social Technology for Economic Development; The Research Institute as a Key Industrial Development Instrument; The Potential of the Computer and High-Speed Information Processing Techniques for Industrial Development; The Iron and Steel Industry in a Developing Economy; The Direct Reduction of Iron and the Less Developed Areas; Food

Processing and the Developing Society; The Significance of the Forest Products Industry in Economic Development; Organization of a Textile Industry—Costs and Benefits to the Economy; Coated Fertilizers for the Controlled Release of Plant Nutrients; Reactor Design for the Hydrogenation of Triglycerides; The Application of Modern Technology to the Processing of Coconuts for Increased Income.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME V. TRANSPORTATION

Agency for International Development. 1962. 165 pages.
PB-207 498

This volume includes the following papers: General, Social, Political, and Economic Factors in Relation to Transport for Less Developed Areas; Strategy Planning for Transportation and Economic Development; Transportation of People and Goods in Large Metropolitan Centers; A Statement of the Urban Passenger Transportation Problem; Highway Planning and Programming in the Economy; Phase Building of Railroads and Equipment for Less Developed Countries; Application of Air Cargo Transport to Feeder Operations in Less Developed Areas; Movement of Commodities by Pipeline; Harbors, Marine Terminals, and Waterways for Less Developed Areas; Integration of Overseas and Domestic Transportation in Developing Countries; New Techniques for Temperature Control of Perishable Goods in Transport and Storage Applicable to the Less Developed Areas; Implication of Current Scientific Research for Future Transportation; the Earth Sciences and Modern Transportation.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME VI. HEALTH AND NUTRITION

Agency for International Development. 1962. 204 pages.
PB-207 499

This volume includes the following papers: Man Meets His Environment; Vital and Health Statistics are Necessary for the Utilization of Science and Technology; Principles of Health Service Planning; Occupational Health, the Development of a New Public Health Discipline in Peru; The Fluorescent Antibody Technique as a Simple, Rapid Diagnostic Method; Cause and Control of Fatal, Infantile Diarrheal Diseases; Vaccination Against Measles; Management of Typhoid Fever and Its Complications; Bilharziasis, A Major Disease Problem Intimately Associated With Economic and Social Development; Advances Toward Prevention and Control of Trachoma; Psychiatric Problems in Developing Countries; Malaria Experience—Liberia, Iran and Jordan; The Impact of Malaria Eradication on the Development of Nepal; The Provision of Facilities for Medical Research and Its Future Organization.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME VII. SOCIAL PROBLEMS OF DEVELOPMENT AND URBANIZATION

Agency for International Development. 1962. 99 pages.

PB–207 500

This volume includes the following papers: Patterns of Worldwide Cultural Change in the 1960's; Social Stratification and Social Mobility in the Development Process; Toward a Theory of Community Development; The Role of the Family in Industrialization; Adjusting Rural People to an Urban Environment; The Implications of Urbanization for the Village and Rural Sector; Organization for Planning and Development of Metropolitan Areas; Housing and Community Facilities as Factors in Human Development; Capital Requirements for Urban Social Overhead; The Political Implications of Urbanization and the Development Process.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME VIII. ORGANIZATION, PLANNING, AND PROGRAMMING FOR ECONOMIC DEVELOPMENT

Agency for International Development. 1962. 156 pages.

PB–207 501

This volume contains the following papers: Some Aspects of the Strategy of Development Planning—Centralization vs. Decentralization; Public Planning and Private Decision-Making in Economic and Social Development; Criteria for Decision-Making in Economic Planning—The Planning Process and Planning Objectives in Developing Countries; National Development Planning and Regional Economic Integration; National Planning and Multinational Planning under the Alliance for Progress; International Commodity Markets as a Factor in Development Planning; Determining the Need for and Planning the Use of External Resources; A Model of Development Alternatives; The Use of Accounting Prices in Planning; Principles of Simulation; Planning as a Continuing Process; The Place and Functioning of a Planning Agency Within the Government Organization of Developing Countries; Development Banks.

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SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME IX. SCIENTIFIC AND TECHNOLOGICAL POLICY, PLANNING, AND ORGANIZATION

Agency for International Development. 1962. 102 pages.

PB–207 502

This volume includes the following papers: Science and Public Policy; Science as a Factor in Economic Growth; The Loss of Scientists from Less to More Developed Countries; Role of a Research Institute; The Role of the National Laboratory; Agricultural and Industrial Extension Services to Diffuse Technological Knowledge.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME X. INTERNATIONAL COOPERATION AND PROBLEMS OF TRANSFER AND ADAPTATION

Agency for International Development. 1962. 72 pages.

PB-207 503

This volume includes the following papers: The Emerging International Culture; Technical Assistance—New Dimensions for Professionalism; Training and Assistance in Development Planning; Guidelines in the Process of Change; Economic Development in Puerto Rico; Voluntary Associations and Development; Cooperative Programs for Strengthening Engineering Education; Revitalization Movements in Development.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME XI. HUMAN RESOURCES. TRAINING OF SCIENTIFIC AND TECHNICAL PERSONNEL

Agency for International Development. 1962. 216 pages.

PB-207 504

This volume includes the following papers: High-Level Manpower Development and Economic Growth; Population and Labor Force Resources as Factors in Economic Development; Manpower Projections and Techniques; Techniques of Manpower Assessment; The Entrepreneurial Element in Economic Development; Improving Public Management in Newly Developing Countries; Skilled Manpower Training to Support Industrial Growth in a Developing Nation; Some Aspects of Management and Skilled Supervision; The Development of Latin American Specialists in the Chemistry of Occupational Health; Women in the Labor Force; Occupational Safety in a Newly Developing Industrial Area; Planning Policies for Investing in Scientific and Technological Education; Programming of Science and Technology Within the Educational Structure; Principles and Policies for Developing a Comprehensive Program for Improvement of Science Education; Programs for the Improvement of Primary School Education in Science and Mathematics; Programs for the Improvement of Secondary School Education in Science and Mathematics; The Requirements for Major Curriculum Revision; Specialized Training for the Improvement of Secondary School Teachers in Science and Mathematics; Specialized Training for Developing Basic Scientific and Technological Cadres in Developing Countries of Africa; Books and Economic Development; Identification and Development of Talent in Young Children.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT. VOLUME XII. COMMUNICATIONS

Agency for International Development. 1962. 172 pages.

PB–207 505

This volume includes the following papers: New Uses of Mass Communication for the Promotion of Economic and Social Development; Modern High Frequency Telecommunications; Model for Application of a New System of Communication to Modern Educational Methods; Low Power Drain Television Receiving Systems; Basic Planning for a Communications System; Experience of the United States in Bringing Modern Telephone Service to Unserved Areas; Advances in and Uses of Tropospheric Scatter Techniques for Communications; The Use of Microwave Radio for Telecommunications; The Impact of Communications Satellites on the Less Developed Areas; The Relationship of Telecommunications in Air Transport to National Development Goals; VHF/UFH Mobile Radio Communications for Flexibility.

PA MONG STAGE ONE FEASIBILITY REPORT

U.S. Department of the Interior, Bureau of Reclamation. 1970. 575 pages.

PB–207 603

The Mekong River is one of the largest single natural resources in Southeast Asia. The Pa Mong project, which involves a portion of the Mekong Basin in Laos and Thailand, will greatly affect the regimen of the river and will have a tremendous influence not only on the immediate project area but on much of Southeast Asia. Stage 1 of the Pa Mong project encompasses dam construction, production of approximately one half of the ultimate power, and a small portion of the irrigation capacity. This document and its appendices represent a comprehensive feasibility report of Stage 1. The basic document includes discussions of the general features of the area, the problems and needs of the area, land and water resources, plan of development, designs and estimates, agricultural economy, power, corollary effects of the project, anticipated economic impacts from project development, social and human considerations, and economic and financial analysis.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX I. LAND RESOURCES

U.S. Department of the Interior, Bureau of Reclamation. 1970. 355 pages.

PB–207 604

This Appendix presents details on the findings and conclusions of land resources investigations in the Stage 1 Area, Pa Mong project, Laos and Thailand. Its primary purpose is to support the findings, conclusions, and recommendations relative to the suitability of the lands for irrigation presented in the overall Stage 1 report. Land suitability was measured in terms of economic productivity expressed as expected net income. The irrigation suitability investigations involved various supporting studies, including field and laboratory measurement of soil physical and chemical properties; land productivity studies, both physical and economic; land development studies; irrigation water quality studies; and land drainability studies.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX III. HYDROLOGY AND CLIMATOLOGY

U.S. Department of the Interior, Bureau of the Interior, Bureau of Reclamation. 1970. 500 pages.

PB–207 605

The Pa Mong project is envisioned as including a concrete dam across the Mekong River, about 20 kilometers upstream from Vientiane, Laos, plus two additional dams on the adjacent watersheds incorporated into a large reservoir for multipurpose development, with associated power and irrigation facilities. The Stage 1 area of the project is located immediately east of the Pa Mong Reservoir in both Laos and Thailand. This Appendix to the basic Stage 1 Feasibility Report provides details on the region with respect to hydrology and climatology; available climatological data; water resources; water requirements; water utilization; flood hydrology; and fluvial hydraulics and sedimentation.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX IV. GEOLOGY. VOLUME I

U.S. Department of the Interior, Bureau of Reclamation. 1970. 575 pages.

PB–207 606

This Appendix contains the geologic supporting data for the Pa Mong Stage 1 report. These data are largely the subsurface and surface information on foundation and construction materials obtained for use in the preparation of designs and cost estimates of engineering structures. It also contains general geologic data relevant to the water-holding capability of the reservoir and geologic data related to design and construction problems anticipated during the development of the project. This Volume of the Appendix contains the text and illustrative data; Volume 2 contains supporting data such as drill logs and auger hole logs.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX IV. GEOLOGY. VOLUME II. PART 1

U.S. Department of the Interior, Bureau of Reclamation. 1970. 750 pages.

PB-207 607

This Appendix contains the geologic supporting data for the Pa Mong Stage 1 report. Volume II contains data in support of the text of Volume I. This first part of Volume II is comprised of drill logs, electric logs, photos of drill cores, and construction material logs for the Pa Mong, Man Lik, and Nam Mong damsites.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX IV. GEOLOGY. VOLUME II. PART 2

U.S. Department of the Interior, Bureau of Reclamation. 1970. 425 pages.

PB-207 608

This Appendix contains the geologic supporting data for the Pa Mong Stage 1 report. Volume II contains data in support of the text of Volume I of the appendix. This second part of Volume II is comprised of drill logs, drill core photographs, and construction material logs for Huai Sai Gap, Chong Khao San dike, and Pa Mong—Nam Mong saddle.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX V. PLANS AND ESTIMATES. VOLUME I

U.S. Department of the Interior, Bureau of Reclamation. 1970. 620 pages.

PB-207 609

This Appendix supplies supporting data and exhibits used in the preparation of the Plan of Development and Designs and Estimates Chapters of the Pa Mong Stage 1 Feasibility Report. It includes plan formulation studies and analyses, and designs and detailed cost estimates of project features. This first volume of the Appendix includes: General information concerning the area, especially its water supply and land resources; the plan of development; and designs and estimates.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX V. PLANS AND ESTIMATES. VOLUME II

U.S. Department of the Interior, Bureau of Reclamation. 1970. 460 pages.

PB–207 610

This Appendix supplies supporting data and exhibits used in the preparation of the Plan of Development and Designs and Estimates Chapters of the Pa Mong Stage 1 Feasibility Report. This second volume includes sections on construction costs, land development costs, and annual operation, maintenance and replacement costs.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX VI. ECONOMICS, AGRICULTURE, SOCIAL AND FINANCIAL ANALYSIS

U.S. Department of the Interior, Bureau of Reclamation. 1970. 478 pages.

PB–207 611

This Appendix to the basic Pa Mong Stage 1 report contains findings and analyses under three main sections: (1) General and agricultural economy; (2) Economic impacts and social considerations; and (3) Economic and financial analysis of the Stage 1 portion of the Pa Mong project. Discussions of the methods employed, and the findings and conclusions are presented for each of the sections. Since the project will considerably influence the national economics of Laos and Thailand, the studies were conducted on a macroeconomic scale as well as a microeconomic scale.

PA MONG STAGE ONE FEASIBILITY REPORT. APPENDIX VII. COROLLARY STUDIES

U.S. Department of the Interior, Bureau of Reclamation. 1970. 445 pages.

PB–207 612

This Appendix to the Pa Mong Stage 1 Feasibility Report is comprised of a series of reports by authors outside the Reclamation Bureau. They represent studies in many disciplines and introduce some of the complexities and challenges associated with the development of the project. The topics covered include: Fisheries aspects; recreation study; cadastral survey; evaluation of the navigation benefit of the project; flood control benefits; project startup and estimation for establishment of displaced persons settlement; provincial, rural, and industrial consumption water requirements; mineral resources in the area upstream from Pa Mong; wildlife survey; forestry survey; public health; archaeology of the Pa Mong Reservoir site.

REPORT ON POTENTIAL GROWTH OF AQUATIC PLANTS OF THE LOWER MEKONG RIVER BASIN. LAOS-THAILAND

Corps of Engineers. February 1970. 123 pages.

PB–207 613

The Pa Mong project involves a hydroelectric power and irrigation system on the Mekong River, in Laos and Thailand. Concern has been expressed as to what extent aquatic vegetation, such as water hyacinth, will interfere with the operation and maintenance of the project. This document is the report of a team that was assembled to assess problems, evaluate present methods of dealing with these problems, and make design and research recommendations relevant to multi-purpose water resource projects in the Lower Mekong Basin. Included in the report are a section on growth potentials describing a number of local factors bearing on the aquatic weed problem; a discussion on the floating, submersed and emersed, and marginal aquatic plants in the area surveyed; and a detailed description of the various measures for aquatic plant control.

RURAL INDUSTRIAL TECHNICAL ASSISTANCE (RITA)

Federal University of Rio Grande do Norte, and Utah State University. L. C. Taylor, D. Andrade, R. Collier, and G. Seely. July 1971. 129 pages.

PB–207 626

Project RITA (Rural Industrial Technical Assistance), Rio Grande do Norte, Brazil, was a program designed to provide assistance in industrial development to selected areas in the interior of the State of Rio Grande do Norte. The project team consisted of professors and graduate students from the Federal University of Rio Grande do Norte and from Utah State University. Their efforts involving the study, selection, planning, organization, and establishment of small and medium sized businesses in the project area are reported in this document.

TRADE AND DEVELOPMENT: TRADE PERFORMANCE AND PROSPECTS OF DEVELOPING COUNTRIES

Agency of International Development. Keith Jay. October 1971. 48 pages.

PB–207 627

The impact of foreign trade on economic growth is multiple and complex. Recent experience clearly demonstrates that a strong export performance is associated both with a rapid internal growth rate and with a relatively allocative price system. This report was prepared to provide a general background on trade matters in less developed countries. It deals with the importance of trade for these countries, their past and current trade performance, exports of primary products, exports of manufactured goods, the directions of trade performance, and prospects for future trade development.

THE SOCIAL FEASIBILITY OF PA MONG IRRIGATION. REQUIREMENTS AND REALITIES

U.S. Department of the Interior, Bureau of Reclamation. Jasper Ingersoll. July 1968. 286 pages.

PB–207 637

An irrigation project does not involve a single agriculture practice, such as receiving more water. It may, in fact, be regarded as a complex interrelationship of three systems: a physical system, an economic system, and a social system. The first two are fairly familiar; but the third, a social system, has not been widely studied despite its actual importance in determining the success of an irrigation project. This report presents the results of a study on the social aspects of the irrigation phase of the Pa Mong project on the Mekong River. The first part seeks to identify the conditions required for effective irrigation. The second part deals with the current conditions and apparent change in the project area in Laos and Thailand. The third part is an attempt to assess the social feasibility of Pa Mong irrigation by noting the relationships between the required conditions for effective irrigation and the current conditions and trends of life in the area.

BIBLIOGRAPHY OF REPORTS RESULTING FROM U.S. GEOLOGICAL SURVEY PARTICIPATION IN THE UNITED STATES TECHNICAL ASSISTANCE PROGRAM, 1940-67

Department of the Interior, Geological Survey. Jo Ann Heath, and Nancy B. Tabacchi. 1968. 75 pages.

PB–207 863

Since 1940 the U.S. Geological Survey has assisted the developing nations in a wide range of investigations, including mineral resource appraisal, geologic and related studies, establishment of geologic and hydrologic agencies, and training of earth scientists. This bibliography lists publications resulting from the scientific, technical, and administrative work of the U.S. Geological Survey and counterpart agencies in 51 countries during the period 1940-67. The reports are listed by country or region and are indexed by subject and author.

SPACE TECHNOLOGY TRANSFER AND DEVELOPING NATIONS

Arthur D. Little, Incorporated. Peter E. Glaser, Robert M. Jolkovski, Claudio Margueron, and Walter M. Noel. October 1968. 158 pages.

N68–37216

This report describes a study made to determine the prospect of applying space-developed technology to the technology needs of developing nations, using Brazil as an example of a developing nation. An examination was made of Brazilian industry, government, and social structure to identify these needs. Documented technology in the NASA information system was matched against Brazilian economy's needs, and it was concluded that space-generated technology is relevant to the needs of developing nations. Summaries are given of specific examples of NASA research considered applicable in solving Brazilian problems.

AID/NASA PILOT PROJECT IN TECHNOLOGY TRANSFER TO A DEVELOPING NATION, KOREA. PHASE II. TRAINING OF KOREAN SPECIALISTS

IIT Research Institute. December 1970. 153 pages.

N71–35167

The document describes how a team of Korean specialists from the Korea Institute of Science and Technology utilized NASA-provided information facilities in the United States and search techniques to learn technology transfer techniques and to develop a working knowledge of technical resources available. The exercise involved actually processing trial problems through the various stages of complete problem definition, literature search, information evaluation, and follow-up. Of 47 problems which were defined and put in process, 13 produced potentially relevant technology. In addition to receiving training in information retrieval, the team toured the Technical Research Center of Owens-Illinois, Incorporated to see how the services of a regional dissemination center are used in industry. Also, presentations were made to the team on various areas of technology transfer.

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CHEMISTRY

Beneficiation and Refining

REMOVING BISMUTH FROM LEAD WITH A SUBMERSIBLE CENTRIFUGE

Bureau of Mines, College Park Metallurgy Research Center. D. Montagna, and J. A. Ruppert. 1972. 14 pages.

PB–208 005

The commercial Kroll-Betterton process for debismuthizing results in the formation of bismuth-containing dross. Present practice in the industry is to hand-skim off this dross, which contains considerable amounts of entrapped lead. An improved technique has now been developed which involves the use of an argon-shrouded dipping centrifuge to perform the required separation. The technique provides better control in removing drosses, faster operation with less oxidation and relatively little fuming, and recovery of a lead bullion that approaches commercial specifications.

———o———

RECOVERY OF ALUMINUM FROM ALUMINUM-SILICON ALLOYS

Bureau of Mines, Boulder City Metallurgy Research Laboratory. E. L. Singleton, R. L. deBeauchamp, and T. A. Sullivan. 1972. 16 pages.

PB–208 006

The current commercial process for producing aluminum involves the conversion of bauxite ores to alumina and subsequently electrowinning aluminum metal from the oxide. A process has now been developed which may open the way for the utilization of aluminum silicate ores in place of bauxite. The basic step in the process, which permits the recovery of aluminum of a higher quality than primary-grade aluminum, is a molten-salt electrolytic extraction. As compared to the current process, the new procedure requires a lower operating temperature, eliminates the preparation of alumina, employs less costly electrolytes, and consumes no carbon for removal of oxygen. In addition, under certain conditions a metallurgical-grade silicon can be obtained as a byproduct.

———o———

FLOTATION OF PYRITE FROM COAL

Bureau of Mines, Pittsburgh Energy Research Center. K. J. Miller, and A. F. Baker. February 1972. 10 pages.

PB–208 015

Although the sulfur in coal appears primarily in two distinct forms, organic and pyritic, it is recognized that the sulfur content of some coals could be significantly reduced if most of the pyrite

Beneficiation and Refining
(continued)

were physically removed during coal preparation. Most of the pyrite, including the finely disseminated fraction, in coal can now be removed by froth flotation by a two-stage procedure described in this report. The coarse, free pyrite must be rejected with other high-ash refuse during a first-stage coal flotation. The fine size or unliberated pyrite remaining in the concentrate can then be removed by flotation with a pyrite promoter in a second stage, while the coal is simultaneously depressed.

Chemical Analysis

THE ISOLATION AND DETERMINATION OF AROMATICS IN GASOLINE BY GAS CHROMATOGRAPHY

Southwest Research Institute. L. L. Stavinoha, and F. M. Newman. April 1972. 20 pages.

AD–739 540

Evaluation and control of the aromatic hydrocarbon content of motor gasolines have necessitated the development of quantitative methods of analysis for the determination of aromatics. Gas liquid chromatographic analyses involving selective separation of saturates and olefins from aromatics through the use of polar liquid phases offer advantages in specificity when compared to other approaches. However, the existing standard method using separation has an upper temperature limit of 300 F, which excludes the analysis of motor gasolines. This upper limit has been extended by the method described in this paper. The method combines selective isolation with a highly repeatable sampling technique and a quantitative analytical separation method. Aromatics having components as high as 486 F are quantitatively determined, and an extended method provides for the analysis of fuels having boiling points as high as 550 F. Procedures are also given for the determination of the boiling-point distribution of both the aromatic fraction and the saturate-olefin fraction of the gasolines.

METHODS OF ANALYZING AND TESTING COAL AND COKE

Bureau of Mines, Pittsburgh Energy Research Center. 1967. 92 pages.

PB–209 036

To aid the consumer in the selection of coals for commercial processing, numerous test methods have been developed in the U.S. and abroad to appraise coal properties more intelligently. This bulletin includes the analytical and test methods which are used regularly by the Bureau of Mines. Analytical methods included for the first time are the flame spectro-photometric method for the determination of alkali oxides, and potentiometric determination of chlorine in coal, as well as rapid methods for analysis

Chemical Analysis
(continued)

f coal ash. Additional test methods include the determination f the grindability of coal, equilibrium moisture in coal, and float-nd-sink analysis. Plastometric and dilatometric methods to de-ermine the coking properties of coals are described, as well as ssay procedures for the appraisal of low-temperature carboniza-ion yields.

Desalination

RECOVERY OF SALTS FROM SALINE WATERS VIA SOLVENT EXTRACTION

Dow Chemical Company. R. R. Grinstead, and J. C. Davis. January 1968. 125 pages.

PB–206 319

The concentrated brines resulting from the desalination of seawater and brackish ground water represent both a problem of disposal and an opportunity for the recovery of valuable substances. A method that seems well suited for the treatment of brines for product recovery is liquid-liquid extraction. The report describes work on the “mixed ionic” or “organic salt” system applied for this purpose. The first, and major, portion concern an examination of extraction systems containing only high molecular weight amines and alkylammonium salts. Extraction studies are reported also which involve mixed ionic systems, consisting of alkylammonium carboxylates, which extract both components of an inorganic salt. Consideration is given to several potential applications of mixed ionic solvent extraction systems. These include the recovery of magnesium compounds, recovery of bromine and iodine from brines, separation of nitrate from aqueous systems, and softening of seawater with by-product recovery.

DISTILLATION DIGEST. VOLUMES 3 AND 4

U.S. Department of the Interior, Office of Saline Water. October 1971. 421 pages.

PB–206 451

This document is a compilation of reports on development work done by various contractors on either multistage flash (MSF) distillation or vertical tube evaporation (VTE) of seawater or brackish water. Some of the topics covered include: Vertical tube bundle test vehicle; direct contact condensation MSF distillation process; vertical tube evaporator versus multistage flash; scale control by the seeding process; a 2.5-MGD horizontal-tube multiple-effect plant; operation of a MSF pilot plant on polluted water; fabrication of smooth tubes for large MSF desalination plants; shellside pressure drop in MSF condensers; performance characteristics of advanced evaporator tubes for long-tube vertical evaporators; use of corrugated tubes in MSF evaporators; improved PPB oxygen analyzer for sea water; MSF distillation plant with aluminum heat transfer surfaces; analysis of heat transfer fouling in sea water evaporators; prediction of horizontal tube condenser performance; VTE utilizing vortex flow and interface enhancement; conversion of desalination plant brines to solids; correlation of fluted tube heat transfer data. Volumes 1 and 2 in this series are described on pages 5 and 6 of the January 1972 issue of AMTID.

SUMMARY EVALUATION OF CONCEPTUAL DESIGN FOR 50 MGD DESALINATION PLANT

Technology Services, Incorporated. A. B. Metzger. August 1967. 126 pages.

PB–207 018

This report presents comparative evaluations of conceptual design studies submitted to the Office of Saline Water, U.S. Department of Interior, by 15 contractors for distillation plants for producing 50 million gallons per day (MGD) of fresh water from seawater. The purpose of the design studies was to secure ideas of processes and structural designs through the development of a complete plant concept and to obtain the supporting data for the designs. Four different types of distillation processes were included among the proposals. The report includes discussions and tabulations concerning construction materials for plant equipment, feedwater treatments for scale and corrosion control, and post-treatments for product water.

DEVELOPMENT OF CORROSION PROBES FOR SALINE WATER APPLICATIONS

Battelle Memorial Institute, Pacific-Northwest Laboratories. V. F. Fitzpatrick. July 1968. 72 pages.

PB–207 031

Corrosion probes that will detect and measure galvanic and crevice corrosion in seawater systems by resistance and polarization measurements were developed and are described in this report. The probes were evaluated in ambient seawater and in laboratory and pilot desalination plants to temperatures of 150C. The probes provide a valuable tool for in-line measurement of nonuniform corrosion. The data from the probe evaluation have provided some significant insight into the nature of galvanic attack. The evaluation of a number of commercial corrosion probes is also described.

DESIGN STUDY OF LARGE MULTIPLE PHASE EJECTOR DRIVEN DESALINATION PLANTS

Kaye Instruments, Incorporated. George F. Harper, and John H. Leigh. October 1971. 79 pages.

PB–208 065

It is thermodynamically wasteful to use a fossil-fuel-fired boiler solely to generate low temperature steam for driving distillation desalination plants. The use of multiple phase ejectors driving vapor-compression evaporators in large purpose desalination plants offers an efficient means for utilizing this thermodynamic availability difference between the high-temperature steam that boilers are capable of producing, and the relatively low temperature steam required to drive the plant. This report is a result of a conceptual study of the optimum use of such an arrangement with seawater distillation plants. Included are detailed analyses of ejector-driven plants, and the optimization parameters of the most promising plant arrangement derived from the thermodynamic analyses. The optimum plant combines vertical tube evaporators utilizing enhanced tubes and multistage flash heaters. Cost and production estimates are given.

Inorganic Chemicals

CADMIUM OXIDE

Hughes Aircraft Company, Electronic Properties Information Center. M. Neuberger. June 1966. 63 pages.

AD–486 595

ZINC SULFIDE

Hughes Aircraft Company, Electronic Properties Information Center. D. B. Carter. November 1966. 187 pages.

AD–803 885

CADMIUM SULFIDE

Hughes Aircraft Company, Electronic Properties Information Center. M. Neuberger. March 1967. 258 pages.

AD–810 354

DIAMOND

Hughes Aircraft Company, Electronic Properties Information Center. M. Neuberger. March 1967. 160 pages.

AD–812 827

CADMIUM TELLURIDE AND THE CADMIUM TELLURIDE-MERCURY TELLURIDE SYSTEM

Hughes Aircraft Company, Electronic Properties Data Center. M. Neuberger. August 1967. 215 pages.

AD–819 287

BORON NITRIDE

Hughes Aircraft Company, Electronic Properties Data Center. M. Neuberger. November 1967. 94 pages.

AD–824 733

Each of these reports is comprised of a compilation of a wide range of electronic and other physical properties of the material under consideration. Included is the available information on optical, transport, energy band, photon and electron emissivity, thermal, and other properties. Each property is compiled over

Inorganic Chemicals
(continued)

the widest possible range of parameters, and the data are presented largely in the form of graphs and tables. A bibliography of source literature is included in each document.

SELENIUM AND TELLURIUM: A MATERIALS SURVEY

Bureau of Mines. Arnold M. Lansche, and David F. Davidson. 1967. 64 pages.

PB–207 361

Selenium and tellurium are rare elements in the earth's crust; the principal commercial supplies are byproducts from the smelting and refining of copper and lead concentrates. This report provides basic information on the two elements. It comprises a worldwide survey of uses, properties, substitutes, toxicology, supply, distribution, industrial structure, research and development, and resources.

THE CHEMISTRY OF GYPSUM AND ITS DEHYDRATION PRODUCTS. VOLUME I: THE PHASES AND THEIR STABILITY AND SOLUBILITY. PART 3: THE SOLID-SOLUTION INTERFACE. PART 4: THE CALCIUM SULFATE-MELT INTERFACE

Stanley Evan Edinger. April 1972. 276 pages.

PB–208 280

This document is part of a multivolume work consisting of an annotated bibliography, and collection of papers on the chemistry of gypsum and its dehydration products. The work will serve as a comprehensive coverage of the literature, dating from antiquity to the present. Parts 3 and 4 is a bibliography of the literature on the calcium sulfate-solution interface (acids, bases, salts, organic compounds, and water) and the calcium sulfate-melt interface. Each entry is accompanied by an annotation or abstract. Parts 1 and 2 are described in the April 1972 issue of AMTID (AID–OST–72–2), page 11.

Waste Processing and
Materials Recovery

A MANUAL OF ELECTROSTATIC PRECIPITATOR TECHNOLOGY. PART I–FUNDAMENTALS

Southern Research Institute. Sabert Oglesby, and Grady B. Nichols. August 1970. 338 pages.

PB–196 380

A MANUAL OF ELECTOSTATIC PRECIPITATOR TECHNOLOGY. PART II–APPLICATION AREAS

Southern Research Institute. Sabert Oglesby, and Grady B. Nichols. August 1970. 584 pages.

PB–196 381

This manual is a comprehensive report on the state of technology of electrostatic precipitation for particulate emission control. It is intended to serve as a basic handbook on the subject covering the entire system, including fundamental theory, design, operation, and application. The primary objective is to provide a source of information that will benefit the researcher, manufacturer, and user of electrostatic precipitators (EP's). Part I covers: Corona generation; the electric field; particle charging; particle collection; gas flow; rapping and reentrainment; resistivity and conditioning; EP systems analysis; design methodology; mechanical components; power supplies and controls; measurements; troubleshooting and maintenance; electrostatic augmentation and unusual precipitation designs. Part II includes: EP's in the electric utility industry; EP's in the pulp and paper industry; EP's in the iron and steel industry; EP's in the rock products industry; EP's in the chemical industry; application of EP's in cleaning municipal incinerator dusts; application of EP's in the nonferrous metals industry; application of EP's to the cleaning of high pressure, high temperature gases; new precipitator applications.

FEASIBILITY OF TREATING WASTEWATER BY DISTILLATION

University of Florida. February 1971. 85 pages.

PB–206 145

The need for improved water pollution control combined with an increasing scarcity of natural waters has led to the concept of wastewater renovation for reuse. One treatment method that has potential for producing a high quality water from wastewater is distillation or evaporation. This report describes the results of an investigation of the technical feasibility of evaporation of municipal sewage treatment plant effluent for the purpose of water reuse. The equipment used was a long tube vertical (LTV) evaporator. The objectives of the research were to determine the effects of feedwater quality, and evaporation conditions on product water quality, post evaporation polishing, and evaporator tube scaling. The results indicate that, because of increased efficiencies due to higher operating temperatures and negligible boiling point rise, wastewater evaporation should be more economical than sea water evaporation.

INORGANIC FERTILIZER AND PHOSPHATE MINING INDUSTRIES–WATER POLLUTION AND CONTROL

Battelle-Memorial Institute. September 1971. 228 pages.

PB–206 154

A state-of-the-art survey was made of the water pollution problems which result from the production of inorganic fertilizers and phosphate rock. The specific production operations which are the principal generators of contaminated waste waters are identified, and the waste water volumes and compositions for each operation are given wherever possible. The capability of current technology to treat and control the contaminated waste waters generated by the fertilizer industry is evaluated. Problem areas where additional research and development effort is needed to provide adequate control of waste water discharge are identified.

FLOCCULATION AND CLARIFICATION OF MINERAL SUSPENSIONS

University of Minnesota, Mineral Resources Research Center. May 1971. 126 pages.

PB–206 238

The clarification of plant effluents, particularly those from mineral processing operations, is becoming of much concern for the prevention of stream and lake pollution. For example, magnetite-taconite concentrators, base metal operations, such as copper, lead, zinc, and uranium leaching plants, produce siliceous tailings. This document provides the results of a study of the combined use of a multivalent cation and a polymeric compound as a ffocculant fo rthe treatment of such effluents. It was determined that a combination of starch and calcium chloride may be applied to clarify the siliceous tailings from magnetite-taconite plants and dispersed siliceous slimes. The flocculant will also permit water reuse in the selective desliming-flotation process on non-magnetic taconites.

THE REUSE OF WATER IN MANUFACTURING: AN EXPLANATORY ECONOMIC MODEL WITH DATA ANALYSIS

New Mexico State University, Water Resources Research Institute. F. Lee Brown. January 1972. 32 pages.

PB–207 138

The report proposes an explanatory economic model for determination of water reuse rates in manufacturing based on the classical theory of the firm as a cost-minimizing institution. The data collections available for estimation and testing of this and other models based on cost behavior are examined closely and subjected to detailed test to determine their suitability for predictive uses. The major factors influencing reuse rates are considered.

STATE-OF-THE-ART OF THE MICROSCREEN PROCESS

Engineering-Science Incorporated. Timothy G. Shea. July 1970. 95 pages.

PB–207 255

Microscreening is a special case of filtration in which the medium or screen is a membrane such as woven wirecloth or a perforated plate with apertures as small as 10 microns. Such screens have been used for screening drinking water, removal of secondary effluents from activated sludge, and treating wastewater from industrial processes. A state-of-the-art evaluation is made on the theoretical and practical aspects of microscreening. Some of the topics discussed are solids retention mechanisms, hydraulic mechanisms, particle shear, microscreen design considerations and performance, mathematical models, and empirical concepts for the process. Tabulations are included on raw water and secondary effluent treatment, and backwash.

PROCEEDINGS: WORKSHOP ON POULTRY PROCESSING PLANT WATER UTILIZATION AND WASTE CONTROL

North Carolina State University, and University of North Carolina. Roy E. Carawan (editor). September 1971. 97 pages.

PB–207 790

The document reports on a workshop dealing with the impact of in-plant processing and equipment changes in water management and waste abatement in poultry processing. A demonstration project in a North Carolina plant is described, and the usefulness of results obtained are interpreted for the industry generally. Implementation of water conservation and waste handling programs is discussed in regard to processing, health, and environmental engineering.

FABRICATION AND COST EVALUATION OF EXPERIMENTAL BUILDING BRICK FROM WASTE GLASS

Bureau of Mines. M. E. Tyrrell, I. L. Feld, and J. A. Barclay. 1972. 38 pages.

PB–208 007

The problem of solid waste disposal has become critical in urban planning and engineering, so that various possibilities for recycling and utilization of waste materials are being explored. One promising process is the production of building bricks from high-glass fractions of municipal incinerator residues. The results of an investigation are reported in which common clays, lime, and sodium silicate were used as binders for non-plastic residues. Test bricks were formed by dry-pressing, soft-mud molding, and stiff-mud extrusion. A run of standard size face brick, dry-pressed and fired in a research pilot plant has indicated that SW grade, or weather resistant, glass-clay face brick can be produced on a commercial scale without difficulty. A cost evaluation is presented.

SELECTED OXIDATION OF AUTOMOBILE SCRAP

Bureau of Mines, Twin Cities Metallurgy Research Center. R. E. Peterson, and Charles Prasky. 1972. 24 pages.

PB–208 011

The economic reutilization of scrap iron, particularly that in the form of automobile hulks, has been inhibited because the material usually contains appreciable contaminants which are difficult to deal with. A new selective oxidation process is described which converts this low-value scrap to iron oxide and a dense residual metal of high purity, both of which are expected to be attractive raw materials for iron and steel producers. In the process, scrap is fed to a gas-fired rotary kiln where the combustables are burnt, some of the contaminants are volatilized, thin metal sheet is selectively oxidized, and a residue of metal is produced. The iron oxide may be subsequently used like iron ore. Similar products would result from the selective oxidation of any ferrous scrap containing a combination of light-gage metal and heavier structural members. Scrap having a high ratio of surface area to weight (light-guage sheet, borings, turnings, etc.) would yield only high-grade iron oxide.

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PROCESSING THE PLASTICS FROM URBAN REFUSE

Bureau of Mines, Rolla Metallurgy Research Center. J. L. Holman, J. B. Stephenson, and J. W. Jenson. February 1972. 24 pages.

PB–208 014

Plastic waste is now a worldwide problem, and the amount of plastic waste in urban refuse is expected to double or treble by 1980. The U.S. Bureau of Mines is developing means to reuse and recycle this waste component, and their work has produced some systematic guidelines for processing. A promising method for reclaiming plastics from raw municipal waste involves chopping, air classifying, cleaning, and separating into plastic types by a sink-float method. The separated fractions may then be refabricated (e.g. by hot pressing or by injection molding), or treated thermochemically to recover chemical values (such as hydrochloric acid from polyvinyl chloride).

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RECYCLING OF STEELMAKING DUSTS

Bureau of Mines, Rolla Metallurgy Research Center. P. G. Barnard, A. G. Starliper, W. M. Dressel, and M. M. Fine. February 1972. 13 pages.

PB–208 016

Over 2 million tons of dusts containing approximately 1,100,000 tons of iron are produced by the steelmaking industry each year. This report describes methods for upgrading these dusts to produce high-iron pellets for recycling. The procedures include: Pelletization and reduction roasting to remove lead and zinc;

sulfation with H_2SO_4 or SO_2 followed by leaching to remove copper and zinc and pelletization and reduction to remove lead and metallize the iron; pelletization of mixtures of dusts containing carbon, zinc, and lead followed by roasting to eliminate said elements; and pelletization and roasting of mixtures of blast furnace dusts, basic oxygen furnace dusts, and mill scale.

EVALUATION, EXTRACTION, AND RECYCLING OF CERTAIN SOLID WASTE COMPONENTS

Great Lakes Development Institute. 1972. 126 pages.

PB–208 674

Recycling solid wastes serves the dual function of conserving resources and providing a means of disposal of the wastes. This document describes work leading to the design of a prototype installation for the development of processes for the efficient recovery of useful components from municipal solid wastes. A survey of current technology is presented and that briefly discusses unit extraction processes as well as complete solid waste processing systems under development. The constituents of municipal solid wastes are identified together with the relative weight percentages typically found. The new installation is based on a classifier unit in which the solids settle at a velocity in proportion to their density.

AN INVESTIGATION OF BITUMINOUS HIGHWAY MATERIALS AND METHODS OF PRODUCTION AND CONSTRUCTION CONTROL BASED ON STATISTICAL PROCEDURES

Indiana State Highway Commission, Research and Training Center. B. L. Elkin. December 1971. 139 pages.

PB–207 290

Quality control which utilizes statistical concepts is relatively new to highway construction, and there is an apparent need for a change to include these new ideas. This report presents the findings of many and various tests performed on different types of bituminous mixes from different projects during actual construction. The investigation was designed to collect and measure information about basic properties of the material (asphalt content, aggregate gradation, mix temperature, density of compacted pavement, etc.). The results are analyzed using statistical methods in order to determine the extent of material variability. Various test procedures and methods of analysis which are fast, simple, eliminate bias and the need for personal judgment, and can be readily incorporated in a quality program with proven confidence are described. The results of the study can be used in the development plans for bituminous mixes.

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EVALUATION OF ASPHALT STRUCTURAL PERFORMANCE

Texas A and M University, Texas Transportation Institute. S. C. Britton, D. Bynum, Jr., and W. B. Ledbetter. May 1971. 252 pages.

PB–207 334

It may be surmised that improvements in the prediction and control of a flexible pavement system can be achieved by suitable application of engineering design analysis techniques. An important consideration in the application of such an approach is that data characterizing the basic structural performance behavior of the asphaltic concrete be available and that this behavior will be greatly influenced by asphalt cement structural performance. The results of the study which is the subject of this report indicate that test methods are available which can be applied to reliably evaluate asphalt performance in a fundamental way. The methods are sensitive to significant differences in asphalt content and structural performance, and they can be used to obtain basic pavement design data, to select asphaltic materials, and for asphalt quality control.

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A FIELD EXPERIMENT WITH MINERAL FILLERS

State of Illinois, Division of Highways. Robert J. Little. August 1971. 35 pages.

PB-207 999

Inert mineral fillers are often prescribed to raise the dust content of bituminous concrete mixtures to levels above those normally imparted by the dust fractions of the aggregates that are used. The filler usually specified is dry limestone dust. Eight years of service experience have now shown that several other materials may be substituted for the limestone dust. The materials are hydrated lime, kaolin clay, and asbestos fiber mixed with limestone dust. Samples of dense-grade bituminous concrete showed no important differences attributable to individual characteristics of the mineral fillers.

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CHARACTERIZATION OF ASPHALT CONCRETE AND CEMENT-TREATED GRANULAR BASE COURSE

Materials Research and Development, Incorporated. Keshavan Nair, Wayne S. Smith, and C-Y Chang. February 1972. 320 pages.

PB-208 000

A determination has been made of the applicability of elasticity and viscoelasticity for the characterization of asphalt concrete and cement treated base course for the use in the structural design of pavements. In the context of the available methods of structural design, linear elasticity and viscoelasticity can adequately characterize asphalt concrete provided it is recognized that it is necessary to use approximate procedures to include various response characteristics which are not modelled by the chosen constitutive law. Linear viscoelasticity has the capability of directly modelling more of the response characteristics of asphalt concrete than elasticity. Cement-treated granular base course can be adequately characterized by a linear isotropic elastic constitutive law. Suitable test procedures to determine the necessary material properties are suggested.

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EVALUATION AND PREDICTION OF THE TENSILE PROPERTIES OF ASPHALT-TREATED MATERIALS

University of Texas at Austin, Center for Highway Research. William O. Hadley, W. Ronald Hudson, and Thomas W. Kennedy. May 1971. 110 pages.

PB-208 514

The increased use of asphalt-treated subbases in rigid pavement structures for highways has created need for a rational procedure by which to design these subbases. A design procedure utilizing layered theory, now under development, requires that material characterization constants such as modulus of elasticity, Poisson's ratio, and failure strains be incorporated. The report describes a study which was undertaken to evaluate the effects of seven factors on the tensile properties of asphalt-stabilized materials. These factors were aggregate type, aggregate gradation, asphalt cement type, asphalt content, mixing temperature, compaction temperature, and curing temperature. The results of analysis of variance are included, and indicate the significant main effects, interactions, and quadratic effects for each of the test responses. Prediction equations were obtained for estimating characterization constants.

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Ceramics

DYNAMIC AND THERMAL ASPECTS OF CERAMIC PROCESSING

University of Rhode Island, College of Engineering. P. J. Gielisse, T. J. Kim, and A. Choudry. December 1971. 105 pages.

AD–740 833

The results of studies are described which have added significantly to an understanding of the ceramic grinding process. The importance of wheelspeed is paramount. Increased wheelspeed not only promotes a significantly higher stockremoval rate but imparts a reduction in cutting force while at the same time drastically reducing the wear on the cutting diamond. Present practice seems to act counter to the beneficial factors shown to be available if proper use is made of the influence of grinding wheel size, geometry, concentration strength of diamond, and abrasive distribution on the wheel. Studies of diamond wear and failure show, among other things, that increased diamond life on high-wear type workpieces may be accomplished by proper adjustments of machine, wheel, and/or workpiece parameters. Also, a dynamic-elastic grinding model is presented, and a new piezoelectric dyanamometer is described which permits the study of the impulse of individual cutting events.

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USES OF CERAMICS IN MICROELECTRONICS. A SURVEY

ITT Research Institute. W. R. Bratschun, A. J. Mountvala, and A. G. Pincus. 1971. 174 pages.

N72–13495

This survey examines the properties and behavior of ceramic materials as used in components for electronic circuitry. By citations of specific projects and reports, National Aeronautics and Space Administration contributions to materials, components, and processing microelectronics are identified. The effects of these advances on present and future directions for microelectronics and its applications in industry and consumer goods are appraised; and suggestions are made as to how they may further promote product developments and how the processing innovations may be useful in other technologies. A fairly extensive bibliography is included.

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RELATIVE OPTIMAL REINFORCEMENT PATTERNS FOR FIBER REINFORCED COMPOSITE MEMBRANES

Monsanto Research Corporation. A. A. G. Cooper, and E. M. Wu. September 1970. 53 pages.

AD–876 333

Fiber-reinforced composites (FRC's) can be of great advantage in structures or structural parts requiring a material with distinct directional characteristics. The directional load or stiffness requirements are not always constant throughout the structure; quite often they change rapidly, i.e. the directions and values vary considerably over a short distance. FRC's are most commonly applied in the form of cloth or tape made of continuous straight fibers. Therefore, in order to follow changes in directions, a laminate has to be made consisting of several layers with different orientations. It is obvious that the material is not used very efficiently in these cases of rapidly changing directions, the more so since generally the directional loads and/or stiffness requirements vary simultaneously and significantly as well. In this report, a method is proposed to obtain relatively optimal reinforcements in a FRC membrane. The method is based on the fact that: A reinforcing fiber is most efficiently utilized when it coincides with the direction of maximum required stiffness; and directions of principal trajectories are not dependent on any fiber reinforcement as long as the fibers coincide with those directions.

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FABRICATING REINFORCED PLASTICS BY FLUIDIZED BED TECHNIQUES

Monsanto Research Corporation. R. W. Tock. October 1970. 29 pages.

AD–877 320

Fiber reinforced thermoplastics have been fabricated utilizing fluidized bed techniques. In this process the matrix is applied as a powder and fused to the surface of the fiber to provide a continuous coating. The technique is especially applicable when the polymer cannot be solvent coated on the fiber. The process has an advantage over other melt coating operations since the problem of polymer degradation is minimized. The results indicate that a broad range of composite materials can be prepared using this technique.

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CONTROLLED ORIENTATION OF DISCONTINUOUS FIBERS IN COMPOSITES

Monsanto Research Corporation. T. L. Tolbert. December 1970. 27 pages.

AD–879 156

The tremendous potential of high modulus fibers and whiskers as reinforcing agents for plastics and metals is now well recognized. In a little more than a decade, use of such materials has advanced from laboratory studies aimed primarily at extending glass fiber reinforced plastics technology, or imitating naturally occurring fiber reinforced systems, to commercial manufacture and acceptance of resulting composites as practical engineering materials. A particularly difficult problem in the production of composites reinforced with whiskers and other small-diameter discontinuous fibers, however, has been that of control of fiber orientation. An approach to the elimination of this difficulty is the subject of this report. Yarns of unidirectionally oriented, discontinuous high-modulus fibers and whiskers were successfully produced by a modified vortex spinning process. Both core yarns in which the higher modulus fibers are overwrapped with organic or small diameter glass fibers and all-whisker-yarns were spun. These yarns can be readily incorporated into plastics as reinforcing agents by filament winding and related procedures. The strength of resulting composites is markedly superior to those of similar materials fabricated by other techniques due to well controlled fiber orientation and very uniform fiber overlap.

FRACTURE PROPERTIES OF POLYPHENYLENE OXIDE COMPOSITES

Monsanto Research Corporation. K. L. Trachte, and A. T. DiBenedetto. November 1970. 79 pages.

AD–879 157

All materials contain a distribution of inherent flaws which act as sites for stress concentration. If a stress intensity at one of the flaw tips is produced which is greater than the material can withstand, the flaw begins to grow in size. At some critical condition, the crack front becomes unstable and propagates catastrophically through the remaining cross-section. Fillers, acting as stress concentrators, significantly multiply the number of sites for potential crack growth. Designing against brittle fracture in composite materials is, therefore, of prime importance. To this end, this document provides data concerning the fracture toughness, tensile strength, tensile strain, and initial elastic modulus is provided for thermoplastic polyphenylene oxide polymers filled with a variety of reinforcing agents. The effects of variables such as filler type, filler geometry, the presence or absence of adhesion promoters, filler concentration, and temperature are considered. Also, the various systems are rated relative to one another with respect to overall performance.

THE FRACTURE TOUGHNESS OF EPOXY-GLASS BEAD COMPOSITES

Monsanto Research Corporation. A. T. DiBenedetto, and A. D. Wambach. January 1971. 37 pages.

AD–880 428

The fracture toughness of glass-epoxy composites depends primarily on the ability to dissipate energy in the polymer phase. Factors which enhance polymer roughness also increases the fracture toughness. This report provides data on the influence of glass bead concentration, temperature, adhesion of polymer to filler, water immersion, and curing agent concentration on fracture toughness.

STRENGTH OF SHORT FIBER REINFORCED COMPOSITES

Monsanto Research Corporation. R. E. Lavengood. March 1971. 31 pages.

AD-883 617

There is a growing interest in composites reinforced with a two dimensionally random array of fibers. This is due in part to the use of random mat and sheet molding compounds, and also to the design simplifications permitted by the planar isotropy of these materials. This report presents the results of a determination of the potential strength of epoxy reinforced with randomly oriented glass fibers and a comparison of its structural utility with similar composites reinforced with aligned fibers. In general, the greater strength and planar isotropy found in the random composites make them preferable in all strength-limited and multiaxial applications. Aligned fiber composites are best suited for uniaxial, stiffness critical situations.

CONCRETE-POLYMER MATERIALS DEVELOPMENT, A GOAL-ORIENTED PROGRAM

Brookhaven National Laboratory (AEC). Meyer Steinberg. October 1971. 41 pages.

BNL-50313

The concrete-polymer development program is reviewed in this report. In this program, the ancient technology of concrete is combined with the recent technology of polymers. Concrete-polymer materials may be grouped in several categories: Polymer impregnated concrete, polymer-cement concrete, cementless polymer-concrete, and concrete with coating in depth. The tasks in the program include monomer survey, process technology, measurement of properties, applications development, economic evaluation, and administration. The materials obtained and their characteristics are described. The durability and structural strength of concrete-polymer are much improved over those of conventional concrete. Major potential applications include piping, building panels, bridge decking, distillation vessels, and mine supports. Costs vs product value are briefly discussed.

CONCRETE POLYMER MATERIALS. FOURTH TOPICAL REPORT

Bureau of Reclamation, Division of General Research; and Brookhaven National Laboratory, Department of Applied Science. L. E. Kukacka, and G. W. DePuy (editors). January 1972. 130 pages.

BNL–50328

Concrete-polymer materials offer potential advantages of high strength and improved durability, as compared with conventional concrete. Investigations to date indicate that the most advanced concrete-polymer for construction is polymer-impregnated concrete, in which precast portland cement concrete is impregnated with a monomer system which is subsequently polymerized *in situ*. This document reports the progress of a continuing program to develop concrete-polymer materials as improved materials of construction. The topics covered include: Selection of monomers for the impregnation of concrete; development of impregnation and polymerization techniques; results of tests on polymer-impregnated concretes for ambient temperature applications and for desalting plant applications at temperatures up to 143C; fundamental studies of the physical and mechanical properties of polymer-concrete materials; quality control methods; application to desalting vessels; application to pipe and draintile; marine applications; precast tunnel supports and linings. The previous report in this series (BNL–50275) is described in the April 1972 issue of AMTID (AID–OST–72–2), page 34.

AN INVESTIGATION OF THE RADIATION POLYMERIZATION OF METHYL METHACRYLATE-KAOLIN CLAY COMPOSITES

University of Missouri-Rolla, Graduate Center for Materials Research. K. G. Mayhan, and J. J. Beeson. August 1971. 142 pages.

COO–2057–1

Kaolin clay in a polymer binder is a composite system which shows promise as a new engineering material. It may be machined, milled, and sharpened with tolerances being held; and it may be made to possess superior impact strength. As a substitute for thermosetting plastics, these composites have advantages which include lower cost and fewer handling problems. This report provides the results of an investigation of the radiation polymerization of a vinyl type monomer (methyl methacrylate) with a kaolin clay inorganic additive. This study was directed toward the determination of the kinetic parameters which govern the formation of polymer in the presence of kaolin clay and the characterization of the resulting polymer. The effects of dose rate, total dose and reaction temperature on the rate of polymer formation and on the properties of the polymer formed are reported.

RADIATION CROSSLINKING OF POLYMERS WITH SEGREGATED METALLIC PARTICLES

Drexel University, Department of Metallurgical Engineering. D. T. Turner, A. Malliaris, and R. P. Kusy. January 1972. 95 pages.

NYO-4110

It was previously found that compaction of mixtures of a polymeric insulator and a metallic powder provide materials which are good conductors of electricity and heat for surprisingly low volume percents of metal, e.g. 6% Ni or Cu. The process is cheaper than any previously described, but the materials have poor resistance to heat distortion. It has now been found that this disadvantage may be overcome by radiation-induced crosslinking compacts of either polyethylene or nylon with nickel. A suitable methodology is described, as are general conditions for attaining optimum electrical conductivity and mechanical strength with this class of materials.

Concrete
(Nonbituminous)

ANTIFOULING CONCRETE

Naval Civil Engineering Laboratory. James S. Muraoka. January 1972. 31 pages.

AD-738 826

Concrete is being used in increasing amounts for the construction of various types of undersea structures. These include concrete pilings and wharf structures in harbors, landing ramps, seawater intake systems for desalinization and power plants, unmanned undersea structures, floating barge-like structures, etc. After prolonged exposure in the sea, concrete is covered with a dense marine growth consisting of mussels, barnacles, oysters, tubeworms, bryozoans, sea squirts, and marine plants such as kelp and other algae. This document provides the results of preliminary tests conducted on the effectiveness of various chemical materials in controlling the growth of marine organisms on concrete. After being impregnated with the chemical, lightweight aggregate (expanded shale) was combined with portland cement and water in the usual manner to form concrete. Test specimens were evaluated for attachment by fouling organisms in both tropical and temperate waters, at depths ranging from the surface to 600 feet. Concrete panels containing a mixture of various antifouling chemicals were more effective in preventing the attachment of fouling organisms than those test panels which were treated with a single chemical compound. Such concrete was found to have only about half the compressive strength of comparable untreated concrete, but it was found to bond fairly well to the wet surface of previously made concrete structures. Therefore, to prevent the attachment of marine growth to an existing concrete structure exposed in the sea, the antifouling concrete developed in this study could be cast as a layer over the surface of the existing concrete or the antifouling concrete could be precast and then attached to the existing concrete, as inside a seawater conduit. Such a precast concrete could be removed and replaced when its antifouling properties are dissipated.

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EFFECTS OF SEA WATER ON CONCRETE

U.S. Army Engineer Waterways Experiment Station. Bryant Mather. December 1964. 20 pages.

AD–739 563

Damage to concrete exposed to sea water, if it occurs, usually results from failure to use good practices in concrete construction. This report reviews some aspects of the problem. Consideration is given to, first, the factors characteristic of sea-water exposure that can affect concrete; second, the elements of the specific concrete involved that may be affected by these factors; third, the consequences of the interaction of sea water with the concrete; and, finally, the precautions that should be taken to avoid the undesirable performance of the concrete due to its interaction with sea water.

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SHAPE, SURFACE TEXTURE, AND COATINGS OF AGGREGATES

U.S. Army Engineer Waterways Experiment Station. Bryant Mather. February 1965. 40 pages.

AD–739 981

Variations in aggregate particle shape, surface texture, and coatings often significantly affect the behavior of the concretes made from them. This report provides a review of methods of measuring the sphericity, roundness, and surface texture of aggregates; the effects and significance of these properties; the effects of coatings; and U.S. and British standards concerning aggregates for concrete. A bibliography of 117 items is included.

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FIBROUS CONCRETE FOR PAVEMENT APPLICATIONS

Department of the Army, Construction Engineering Research Laboratory. B. H. Gray, and J. L. Rice. April 1972. 17 pages.

AD–741 357

A new paving material has been introduced which provides outstanding performance from thin pavement sections. The material is called fibrous concrete and is composed of conventional portland cement concrete materials with steel fibers randomly dispersed throughout the concrete mass. High first crack strength, ability to carry load after cracking, ability to resist cracks, high spall resistance, and ductility are some of the advantages offered by fibrous concrete over conventional concrete. This report reviews the known material properties of fibrous concrete and provides the results of tests involving the loading of test sections to simulate heavy transport aircraft traffic.

FIBER REINFORCED CONCRETE. A GENERAL DISCUSSION OF FIELD PROBLEMS AND APPLICATIONS

Department of the Army, Construction Engineering Research Laboratory. B. H. Gray. April 1972. 19 pages.

AD–741 358

Fibrous concrete is a composite material consisting of a concrete matrix containing a random dispersion of small fibers. The fibers act as arrestors which restrict the growth of flaws in the concrete matrix from enlarging under stress into cracks which cause failure. This document discusses the results of mix formulation, batching, and placement experience with fibrous concrete. A review is also provided of some current and proposed applications of the material.

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT. THE STATE-OF-THE-ART

Air Force Weapons Laboratory. Guy P. York. October 1971. 99 pages.

AD–888 815

Continuously reinforced concrete (CRC) pavement may be defined as a concrete pavement which is constructed with no transverse joints (other than construction joints) and in which longitudinal steel is continuous throughout its length. Many engineers consider CRC pavements a relatively new type, although the first CRC pavement was built in the 1920's. This report provides a review of the state-of-the-art of CRC pavement. It is the result of a thorough review of the literature, field investigations of highway and airfield CRC pavements, and discussions with foremost experts in the field. Consideration is given the development of CRC pavement, including functional features and general design concepts; the characteristics and performance of CRC pavement; current design procedure; and actual experience with several CRC airfield pavements.

DURABILITY OF BRIDGE DECK CONCRETE. PART ONE: EFFECT OF CONSTRUCTION PRACTICES ON DURABILITY

Pennsylvania State University, College of Engineering. P. D. Cady, R. E. Carrier, T. Bakr, and J. Theisen. September 1971. 76 pages.

PB–206 482

The observation of seven concrete bridge decks during construction and periodically over the succeeding five years have provided data on the effect of construction practices on durability. The types of deterioration of interest were: surface motar deterioration, transverse cracking, fracture planes, and spalling (pothole formation). Lack of proper planning of concrete delivery which caused construction delays, lack of control of concrete quality, and lack of strict inspection of the poured concrete were all found to contribute significantly to accelerated deterioration. Of particular importance to extending durability were the selection of the proper form type and the placement of an adequate concrete cover over the top reinforcing steel mat points.

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AN INVESTIGATION OF THE APPLICABILITY OF ACOUSTIC PULSE VELOCITY MEASUREMENTS TO THE EVALUATION OF THE QUALITY OF CONCRETE IN BRIDGE DECKS

Texas A and M University, Texas Transportation Institute. Gilbert Swift, and William M. Moore. August 1971. 49 pages.

PB–207 992

The foundation for a practical method of evaluating the extent of deterioration of concrete in bridge decks has been established. The method uses pulse velocity measurements as an indication of quality and state of deterioration of the concrete. A portable field-type velocity measuring instrument was developed which appears to be suitable for detecting concrete deterioration on bridge decks and other concrete structures having only one exposed surface.

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STRENGTH OF LIGHTWEIGHT AGGREGATES

Massachusetts Institute of Technology, School of Engineering, Carlos V. Ramos, and Surendra P. Shah. October 1970. 39 pages.

PB–210 139

With increasing applications of lightweight concrete as a structural material, it is necessary to understand the factors affecting its properties in more detail in order to establish more economical mix design methods. Along with the water-cement ratio, the strength and quality of lightweight aggregates is a prime factor influencing strength. Current mix design methods do not explicitly take aggregate strength into consideration. This report describes a technique which permits the estimation of the potential strength of aggregates in concrete from the knowledge of strengths of mortar and concrete and the volume concentration of aggregates. Once the potential strength of a given aggregate is obtained, the strength of concrete made with this aggregate can be predicated with the use of an equation derived in the report. Optimum mix design is thus made possible with the assistance of the technique described.

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FRACTURE MECHANICS AND CORROSION FATIGUE

University of Connecticut, Institute of Materials Science. A. J. McEvily, and R. P. Wei. February 1972. 56 pages.

AD–739 265

Fail-safe and safe-life principles provide much of the basis for modern design philosophy. Both of these philosophies recognize that cracks may be present in a structure, or may initiate early in its service life. A considerable amount of research has been devoted to the study of crack growth in the past fifteen years, and linear elastic fracture mechanics has emerged as the most appropriate framework for these studies. This paper provides a review of the current state-of-the-art in fracture mechanics, particularly in relation to the study of problems in environment-enhanced fatigue-crack growth, more commonly referred to as "corrosion fatigue." The usefulness of this approach in developing understanding of the mechanisms for "environmental embrittlement" and its engineering utility is discussed.

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HYDROGEN STRESS CRACKING OF HIGH STRENGTH STEELS

Naval Air Development Center. Walter Beck, Edward J. Jankowsky, and Philip Fischer. December 1971. 224 pages.

AD–740 111

Hydrogen stress cracking and hydrogen embrittlement first became a matter of serious concern because of frequent failures of low alloy steels which had been heat treated to high strength levels, especially in chromium or cadmium plated structures. More recently hydrogen-induced failures have been observed in parts chemically milled, pickled, or exposed to paint removers. Embrittlement has also been detected on parts installed in boilers, pressurized water reactors, high pressure hydrogenation units, and parts cathodically protected. Sulfide corrosion stress cracking is a very serious problem in the petroleum industry, as are the many encounters with embrittlement of the welding engineer. These topics are discussed comprehensively in this monograph. In addition, other subjects relevant to hydrogen failure are included; e.g., a summary of methods of mechanical testing, crack propagation measurements, and the determination of hydrogen in steel. Case studies are reviewed in which hydrogen embrittlement is involved in fatigue. The differentiation between stress corrosion cracking and hydrogen stress cracking, and the effect of microstructure and composition of steels are also included.

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SPECIALISTS MEETING ON STRESS CORROSION TESTING METHODS

NATO, Advisory Group for Aerospace Research and Development. January 1972. 337 pages.

AD–740 724

This document is comprised of 31 papers presented at a conference which had as its purpose the discussion of the utility and significance of stress-corrosion cracking data to current engineering and design practices, and the development of test techniques for stress-corrosion cracking. Among the subjects covered are the following: Standardization of test techniques; important considerations in the development of test methods; theory of stress corrosion cracking of alloys; pH and potential measurements during stress corrosion of Al alloys; stress corrosion testing of welded joints; screening for stress corrosion cracking susceptibility; stress corrosion testing of Ti alloys; stress intensity values and crack propagation rates during stress corrosion cracking tests of high strength steels; apparatus for stress-corrosion testing; tensile-ligament instability and growth of cracks in a homogeneous Al-Zn-Mg-Cu alloy; system for determining effects of gaseous environments on fatigue and fracture of metals; acoustic emissions and slow crack growth in high strength steel; stress-corrosion behavior of Al alloys in sea water; stress corrosion cracking of martensitic precipitation hardening stainless steels; an accelerated stress corrosion cracking method; microscopic identification of stress corrosion cracking in steels; hot salt stress corrosion cracking of Ti alloys; slow strain-rate experiments in evaluating resistance to environmental cracking; fracture and cracking of welded Ti alloys; influence of thermomechanical treatments of stress corrosion cracking of AISI 4340 steel.

NBS PAPERS ON UNDERGROUND CORROSION OF STEEL PILING

National Bureau of Standards, Institute for Materials Research. W. J. Schwerdtfeger, and Melvin Romanoff. March 1972. 63 pages.

COM–72–50359

Steel pilings have been used underground for many years to transmit loads to lower levels or to resist lateral pressures due to earth and water. While the use of steel is presumably satisfactory because no structural failures have been attributed to the corrosion of underground piles, there is considerable concern that damaging corrosion might occur on steel piles driven in different soil environments. This paper is comprised of four papers describing corrosion of various types of steel piling exposed underground under climatic conditions ranging from semi-tropical to frigid. The first paper describes the physical appearance of piling after exposure from 7 to 40 years in soils with resistivities from 300 to 50,000 ohm-cm and pH from 2.3 to 8.6. The second paper pertains to observations and pit depth measurements on piling exposed to soil affected by both permafrost and thawing conditions. The third paper involves the physical inspection of underground steel piling exposed from 21 to 50 years under a

Corrosion
(continued)

wide variety of environmental conditions. The final paper demonstrates the value of a polarization technique in measuring corrosion.

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Fibers and Textiles

FABRIC DESIGN HANDBOOK

United States Army Natick Laboratories, Clothing and Personal Life Support Equipment Laboratory. Louis I. Weiner. January 1972. 355 pages.

AD–738 581

Maximum-weavable fabrics are the largest class of functional fabrics used by industry. Among many weaves they include: Ducks, poplins, wind-resistant twills and sateens, airplane and balloon cloths, and linings. In designing maximum-weavable fabrics it is always of concern to the designer to know whether his fabric is practical in terms of the capacity of the loom to put in the necessary picks. This report provides tables which are intended to facilitate the designing of this class of fabrics. They eliminate the need for direct computation or for graphical techniques previously used for obtaining the solution of maximum weavability problems. The tables are set up for yarn bulk densities ranging from 0.54 to 4.6; this includes fibers as light as polyethylene and as heavy as stainless steel. Supplementary tables are provided giving yarn bulk densities for all of the commercial fibers and for blends of the most important commercial fibers.

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ROT- AND WEATHER-RESISTANCE OF METHYLOLMELAMINE-TREATED COTTON FABRICS

U.S. Army Natick Laboratories, Pioneering Research Laboratory. Marvin Greenberger, and Arthur M. Kaplin. December 1971. 43 pages.

AD–739 493

There has been considerable interest in the use of resin finishes to render cotton weather- and rot-resistant. Cotton fabrics treated with methylolmelamine resin can achieve a degree of protection unmatched by conventional add-on fungicides. This report is an evaluation of the long-term rot- and weather-resistance of cotton fabrics which was undertaken primarily to compare the protection afforded by available "wet" and "dry" cure methods of applying methylolmelamine. The single "dry" and one of the two "wet" cure methods tested rendered the fabrics considerably more rot-resistant than the second "wet" cure method. All three methods afforded excellent weatherability. The protection provided by all three methods were found to be quite sensitive to processing variables.

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CRIMP AND THICKNESS RELATIONSHIPS IN MAXIMUM WEAVABLE FABRICS

United States Army Natick Laboratories, Clothing and Personal Life Support Equipment Laboratory. Louis I. Weiner. March 1972. 58 pages.

AD–740 161

One area of significance to the textile designer is that of fabric thickness. Thickness determines the rate of heat transfer through a fabric and its moisture vapor permeability. In addition, fabric thickness is a function of the yarn crimp, and the latter is a significant factor in tear strength and abrasion resistance. This report presents the derivation of the equations relating fabric displacement ratio and spacing ratio to overall crimp for maximum weavable fabrics; and it contains tabulations of the solutions of these equations for the plain, three-, four-, and five-harness weaves and for a wide spectrum of yarn balance values. To the fabric designer these tables will be valuable in permitting estimates to be made of fabric thickness and crown height from loom design considerations. To the fabric analyst the tables provide a rapidly available source of the values of the geometric parameters which characterize maximum weavable construction of the various weave types.

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RADIOISOTOPES AND RADIATION IN THE TEXTILE INDUSTRY

Oak Ridge National Laboratory (AEC), Isotopes Information Center. F. J. Miller, and P. S. Baker. February 1972. 47 pages.

ORNL–IIC–29

The major current application of radiation and nucleonic techniques to the textile industry involves the modification of textile fibers by radiation. A good deal of research has been done on other possible applications, but little use is being made of them on a continuing basis. The purpose of this survey is, therefore, to awaken interest in the textile industry of available radiation and isotropic techniques. The topics discussed include textile gaging, tracer applications, radiation treatment, apparatus for use in polymerization, static elimination, soil removal and detergency, eradication of pests, and some miscellaneous applications. Each major use is discussed in a separate section with its own bibliographic references.

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Metals and Alloys

REVIEW OF DIMENSIONAL INSTABILITY IN METALS

Battelle Memorial Institute. R. E. Maringer. June 1966. 32 pages.

AD–487 419

The dimensional stability of a material refers to its ability to maintain its original size and shape over a period of time under specified environmental conditions. This document discusses some of the problems that arise as a result of dimensional instability, and presents data on stability, precision mechanical properties, and stabilization procedures for a variety of materials. Much of the data are presented in graphic and tabular form. A bibliography is included.

A BRIEF SURVEY ON METAL FATIGUE

Princeton University. Byoung Sung Kim, and A. C. Erigen. November 1971. 71 pages.

AD–735 700

The document presents a survey of research on metal fatigue. First, a brief history of fatigue research and the characteristic features of fatigue fractures are reviewed. Various aspects of fatigue testing, including nomenclature, data analysis, and statistical methods, are then introduced. The crack propogation problem, which is the most interesting area in current research, is presented; cumulative damage theories are discussed; and consideration is given to various factors that influence fatigue phenomena. A short account of thermal fatigue and corrosion fatigue is then presented. A discussion of fatigue in composite materials concludes the report.

SYMPOSIUM OF ELECTRODEPOSITED METALS AS MATERIALS FOR SELECTED APPLICATIONS

Battelle Columbus Laboratories, Metals and Ceramics Information Center. C. L. Faust. January 1972. 132 pages.

AD–738 272

The document is comprised of papers presented at a symposium, held in November 1971, which was organized for the purpose of generating practical information on the uses of electrodeposited metals and the properties required for those uses. The topics covered include: Introductory data on properties and applications; physical properties of the precious metals; properties of electrodeposited foils for use in printed circuits; precious metal electrodeposits for electrical contact applications; properties of electroless cobalt and recording technology; strength and ductility of electroformed nickel; nickel electroforming applications; properties of electroplated automotive bumpers; some mechanical properties of electrodeposited lead and lead alloys; electroplate property specifications for metal fasteners; joining aluminum to stainless steel by electroplating.

FRACTURE-SAFE DESIGN OF ALUMINUM AND TITANIUM ALLOY STRUCTURES

Naval Research Laboratory, Metallurgy Division. R. J. Goode, and R. W. Judy, Jr. February 1972. 35 pages.

AD–738 425

High-strength aluminum and titanium alloys are candidate materials for structural applications because of their high strength-to-density ratio. Other relevant factors include the good oxidation, corrosion, and nonmagnetic characteristics for specific alloys. However, the fracture resistance characteristics of these materials is an important factor in determining their fracture-safe reliability. This report contains a summary of available fracture resistance information for those aluminum and titanium alloys produced commercially as large plates. Also described are procedures that have evolved for translating this information into meaningful predictions of flaw size-stress conditions for fracture. The general physical metallurgical characteristics for the generic families of these materials are discussed in relation to their potentials for optimizing aluminum and titanium alloys to high levels of fracture resistance.

NIOBIUM-ZIRCONIUM

Hughes Aircraft Company, Electronic Properties Information Center. D. L. Grigsby. November 1966. 208 pages.

AD–804 473

COPPER

Hughes Aircraft Company, Electronic Properties Information Center. S. J. Welles. May 1967. 346 pages.

AD–817 630

These reports are comprised of a compilation of a wide range of electronic and other physical properties for niobium-zirconium alloys and copper, respectively. Included is the available information on electrical, thermal, optical, transport and other properties. Each property is compiled over the widest possible range of parameters, and the data are presented in graphic and tabular form. A bibliography of source literature is included with each document.

METALLURGY: A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 16 pages.

N72–17500

A number of innovations in metallurgy developed by or for NASA have potential applications outside of the aerospace industry. The document presents descriptions of the mechanical properties of various alloys, ranging from TAZ–8B at +2200°F to investment-cast Alloy 718 at −320°F. It then describes methods of analyzing some of the constituents of various alloys. A form for requesting additional technical information is included.

Metals and Alloys
(continued)

ZIRCONIUM: ITS PRODUCTION AND PROPERTIES

Bureau of Mines, Albany Metallurgy Research Center. 1956. 190 pages.

PB–207 844

Zirconium, one of the so-called transitional metals and formerly considered in the class of rare elements, is actually more plentiful in the earth's crust than nickel, copper, lead, zinc, and some other familiar metals. At one time little more than a laboratory curiosity, it found use as a construction material for nuclear reactors and thus has become important. Its principal source is zircon, $ZrSiO4$, but reduction of this mineral has presented problems. The document, the most comprehensive issued, covers many phases in zirconium metallurgy, including occurrence, mining and ore milling, reduction methods, melting methods, properties, fabrication, alloys, and uses. Chemical and physical characteristics are discussed in relation to manufacture of mechanical parts and fittings.

Miscellaneous Materials

DIELECTRIC CONSTANTS OF RUBBERS, PLASTICS, AND CERAMICS. A DESIGN GUIDE

Hughes Aircraft Company, Electronic Properties Information Center. Richard I. Akawie, and John T. Milek. May 1969. 19 pages.

AD–735 628

This document is a compilation of dielectric constant data for commercially available materials. It is intended to enable engineers and designers to readily select a common rubber, plastic, or ceramic material with a desired dielectric constant. The data are presented in a convenient graphic form.

PROCEEDINGS OF THE CONFERENCE ON CONTINUUM ASPECTS OF GRAPHITE DESIGN, NOVEMBER 9-12, 1970, GATLINBURG, TENNESSEE

U.S. Atomic Energy Commission, Technical Information Center. W. L. Greenstreet, and G. C. Battle, Jr. February 1972. 759 pages.

CONF–701105

In recent years, extensive work has been done and significant advances have been made in characterizing the mechanical behavior of graphites, in developing analytical methods for use in design analyses, and in establishing failure and design criteria. This report is comprised of papers presented at a conference which was held to disseminate and exchange information from a number of endeavors, each with a unique purpose, but all germane to the design and structural analysis of graphite components. The basic topics covered include material characterization, constitutive equations, structural analysis methods and applications, fracture, and structural design criteria.

AN INVESTIGATION OF MARINE BORER RESISTANCE OF POLYMERIC MATERIALS

Naval Research Laboratory. J. D. Bultman, and C. R. Southwell. December 1971. 22 pages.

AD–736 180

Consonant with man's expanding activities in the sea is the need for reliable information on the performance of a wide variety of engineering materials in the marine environment. While considerable information is available concerning behavior of many polymeric materials, e.g., wood, much less is known about the ability of various synthetic polymers to withstand the rigors of the sea. This lack of information becomes critical when expensive marine installations are to be made of which these materials may be a part. This document reports the results of an investigation of the resistance of various polymeric materials to marine borers in a tropical marine environment. In the investigation, 30 different polymer compositions were exposed from periods of 6 to 14 months in waters on both sides of the Isthmus of Panama. In general, no marine boring organisms attacked any of the polymer specimens directly from the water; all damage occurred at the wood-polymer interface of specimens located adjacent to wood. The relative resistances of the various polymer compositions and the effects of various fillers and additives are described.

FAILURE CRITERIA FOR POLYMERIC SOLIDS

Monsanto Research Corporation. L. Nicolais, and A. T. DiBenedetto. January 1971. 36 pages.

AD–880 429

At temperatures well below the primary glass transition, most organic polymers exhibit either brittle or ductile failure, depending upon the load and temperature history imposed on the material. When ductile, these polymers are tough and resistant and when brittle they are not. The difficulty in describing the stress-strain behavior is complicated by many factors, of which the growth and formation of defects during loading is perhaps the most important. This document presents a theory for predicting the stress-strain characteristics of polymeric solids in terms of a description of microdefect formation. It is shown the resulting model quantitatively describes the mechanical behavior of polyphenylene oxide and that by using stress-strain data obtained at constant rate of loading, one can predict the creep behavior of the material at constant load. A description of the ductile-brittle transition is also presented, and it is shown that one can qualitatively define the locus of points separating the ductile from the brittle behavior.

INCREASING SOFTWOOD DIMENSION YIELD FROM SMALL LOGS: BEST OPENING FACE

U.S. Department of Agriculture, Forest Products Laboratory. Hiram Hallock, and David W. Lewis. November 1971. 12 pages.

AD–734 633

The softwood industry must obtain a continually increasing percentage of its production from small diameter logs, and so must increasingly maximize the yield of rectangular shaped specified size lumber from cylindrical logs. A basic problem is determining the location of the first longitudinal cut along the log, designated the best opening face of BOF. The document discusses a computerized method of determining this opening face, utilizing the variables of lumber thickness, width, planning allowance, shrinkage, sawing variation, saw kerf, and log diameter. Three live sawing methods are described: A centered flitch method involving the geometric center of the log, a centered-sawline method involving multiple tandem bandmills, and a variable-face-opening method, a conventional one. Cant sawing methods are also covered. The computer program BOF analyzes all possible combinations for maximum or minimum yield. Much of the material in the report is presented by tables and graphs.

BIOLOGICAL DETERIORATION OF WOODS IN TROPICAL ENVIRONMENTS. PART 3. CHEMICAL WOOD TREATMENTS FOR LONG-TERM MARINE-BORER PROTECTION

Naval Research Laboratory. C. R. Southwell, and J. D. Bultman. December 1970. 30 pages.

AD–736 182

Six chemical wood preservatives were selected for evaluation over long periods of exposure in extremely borer-active marine environments. Two temperature wood species were full-cell pressure-treated with these chemicals and exposed in tropical seas and tropical brackish water for periods up to 90 months. One hundred and thirteen untreated tropical wood species were concurrently exposed in these same waters. Subsequently, 16 of the natural tropical woods considered best for use with pressure preservatives were combined with whole creosote and exposed in the most borer active of the seawater sites for periods exceeding 4 years. This report provides the results of the evaluation. In general, the most promising results were obtained with a relatively few tropical woods which are naturally resistant to limnoria borers combined with a creosote pressure treatment which imparts resistance to teredo borers.

EFFECT OF MANUFACTURING VARIABLES ON STABILITY AND STRENGTH OF WET-FORMED HARDBOARDS

U.S. Department of Agriculture, Forest Products Laboratories. P. E. Steinmetz, and D. J. Fahey. 1971. 10 pages.

AD–736 269

Very limited data have been published and disseminated on the effect of manufacturing variables on the properties of hardwood. Raw materials readily available to the mill are used, and the effect of wood species on board properties receives little consideration. Because boards are not necessarily produced under similar conditions, the variables in producing the pulp and in converting the pulp into fiberboard can influence the quality of the final product. Many of the problems in using hardboard can be traced to linear movement with changes in moisture. The causes oftentimes cannot be properly identified during commercial production; thus this report was compiled to pinpoint some of the variables that have the greatest effect on board quality.

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COMPARISON OF WOOD PRESERVATIVES IN STAKE TESTS

U.S. Department of Agriculture, Forest Products Laboratory. L. Gjovik, and H. L. Davidson. 1972. 92 pages.

AD–740 374

This report tabulates the results obtained by decay and termite exposure of wood stakes, treated by various pressure and non-pressure processes, and exposed at various times since 1938 in Louisiana, Florida, Wisconsin, and Panama. Also included are the results obtained on treated and untreated modified wood products such as plywood, resin impregnated wood, and fiberboard. Over 60 different preservatives were involved in the tests.

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PROCEEDINGS OF THE SYMPOSIUM ON THE EFFECT OF GROWTH ACCELERATION ON THE PROPERTIES OF WOOD

U.S. Department of Agriculture, Forest Products Laboratory. 1972. 258 pages.

AD–740 639

The proceedings contain papers given and transcripts of pertinent discussion at the Symposium on the Effect of Growth Acceleration on Wood Properties, held in November 1971 at Madison, Wisconsin. Specifically, the papers present research results dealing with the effects of growth acceleration techniques (short rotations, tree improvement practices, irrigation, fertilization, etc.) on the wood and pulp properties of commercial woods.

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FEASIBILITY OF USING MEMBRANE-ENVELOPED SOIL LAYERS AS PAVEMENT ELEMENTS FOR MULTIPLE-WHEEL HEAVY GEAR LOADS

U.S. Army Engineer Waterways Experiment Station. C. D. Burns, W. N. Brabston, R. W. Grau. February 1972. 61 pages.

AD–738 839

The trend toward larger transport aircraft is making unprecedented demands on airfield pavements. A relatively new type of structural element for use in flexible pavements has been found to sustain more traffic of the type imposed by heavy multiple-wheel landing gear than does conventional flexible pavement of the same total thickness. The new structure basically involves a thickness of highly compacted lean clay completely encased with a waterproof membrane. In the present case, a polyethylene sheet was used on the bottom and sides, and a polypropylene-asphalt membrane was used on the top surface. The exposed surface may or may not be overlain with a layer of asphaltic concrete. Twenty-four-inch thick pavements constructed in this manner were able to withstand repeated loadings with a 360,000-lb. gross load multiple-wheel test rig. Worn layers of the propylene-asphalt surfacing can be patched very easily by overlaying with new materials.

APPLICATION OF MODEL THEORY TO DESIGN AND EVALUATION OF AIRFIELD PAVEMENT

U.S. Army Engineer Waterways Experiment Station. T. Y. Chou, and O. O. Thompson. March 1972. 75 pages.

AD–741 368

Criteria for designing surfaced and unsurfaced pavement facilities are obtained from testing programs. Full scale tests give reliable data, but they are expensive, time consuming, and productive of only minimum amounts of basic information. Test data are obtainable at reasonable cost and within reasonable time limits by using small scale models and dimensional analysis theory, in the fields of hydraulics, fluid mechanics, and other engineering disciplines. Such techniques may well be extended to pavement engineering. A study was made of model-to-prototype similitude requirements for unsurfaced, landing mat surfaced, and conventional flexible and rigid pavement structures for airfields. An extensive literature search of model studies was followed by identification of important variables, development of mathematical methods, and formulation of requirements for true and distorted models. A short analysis is made of estimating the desired size of a model, and the required power. Recommendations are included.

ECONOMIC UTILIZATION OF GENERAL AVIATION AIRPORT RUNWAYS

Education Research, Incorporated. Robert R. Piper. April 1971. 235 pages.

N72-15244

The study reported in this document treats various aspects of urban general aviation airport economics, with emphasis on pricing as a tool to influence the efficiency of airport operation. The demand for general aviation airport services is discussed, and the direct cost characteristics of the airport are summarized. Questions of the efficient use of an existing airport facility are then explored. The focus here is on the social cost of runway congestion as traffic density at the airport builds up and queues form. An analysis is developed of the trade off between aircraft operating costs and airport costs in terms of runway length. Finally, the difficult transition from theory to practice with respect to pricing strategies is discussed. A series of appendices provides specific information on such topics as aircraft insurance, variable operating costs, depreciation costs, and landing area costs.

AERONAUTICAL TELECOMMUNICATIONS IN SOUTHEAST ASIA

U.S. Department of Transportation. E. K. Shinn, Bruce Hitchcock, and Silas Little. 1970. 272 pages.

PB-210 131

One of the prerequisites for growth and well-being in any region is an efficient transportation system. In areas where road and rail facilities are insufficient, the extreme flexibility and relatively moderate capital requirements of air transport can play a very important role in the development process. However, the safe and economic operation of an aviation system requires an adequate aeronautical telecommunications system. This report is a result of a general survey of existing equipment in Indonesia, Laos, Malaysia, and Thailand. For each country, a description is given of the existing airway operations system, and areas of deficiency are identified. Recommendations are made which are intended to serve as an initial base from which to plan the regional development of an integrated aeronautical telecommunications system.

TUNIS-CARTHAGE AIRPORT TERMINAL DATA. FEASIBILITY STUDY OF TUNIS-CARTHAGE INTERNATIONAL AIRPORT

Bovay Engineers, Incorporated, and R. Dixon Speas Associates. H. Ray Petty, and Richard Smithies. January 1972. 171 pages.

PB-210 183

The air trade demand analysis and forecast which comprises the first section of this report indicates that the unrestrained passenger traffic growth for the Tunis-Carthage Airport will be 4,775,000 passenger movements annually by 1980. The original terminal was designed for 1,000,000 passengers annually. To avoid the problems implicit in this projected descrepancy, the report recommends a number of specific modifications, revisions, and improvements to the terminal facility currently under construction. Also included are estimates of the costs for accomplishing the recommended changes, and projections of anticipated economic benefits derived from them.

Bonding and Joining

STATE-OF-THE-ART REVIEW OF CERAMIC-TO-METAL JOINING

Metals and Controls, Incorporated. John F. Clarke, Joseph W. Ritz, and Edward H. Girard. May 1965. 76 pages.

AD–465 809

This document provides a review of the technology involved in permanently joining metal parts to crystalline ceramic parts. Consideration is given to both mechanical and chemical methods used in the fabrication of structural and electronic components. All major facets of the technology are covered, including joining techniques, materials, apparatus, theories, and test methods.

WIRE-BOND ELECTRICAL CONNECTIONS: TESTING, FABRICATION AND DEGRADATION–A BIBLIOGRAPHY 1957-1971

National Bureau of Standards, Institute for Applied Technology. Harry A. Schafft. January 1972. 58 pages.

COM–72–50031

Small-diameter wire is the principal means of making electrical interconnections in certain microelectronic and low-power discrete and hybrid devices. This electrical interconnection, or wire-bond, is considered to be the wire between two bonded points, the bonds, the bonding surface films, and the underlying material in the immediate vicinity of the bonds. The failure of the wire bond is one of the principal failure modes in these devices. This bibliography is a compilation of more than 245 published articles, U.S. Government reports, U.S. patents, and conference presentations relevant to wire bonds in the subject areas of testing, fabrication, and degradation. Author and subject indexes are included, and sources where reports may be obtained are indicated.

BONDING AND JOINING TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1971. 22 pages.

N72–10404

A number of bonding and joining methods developed by or for NASA have potential applications outside of the aerospace industry. The document describes methods used to bond and join metal components, treats joining technology involving adhesive materials, and presents a collection of shop hints for bonding and joining a variety of items. The methods and techniques should find ready adaptability to industrial uses. A form for requesting additional technical information is included.

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APPLICATIONS OF AEROSPACE TECHNOLOGY INDUSTRY. A TECHNOLOGY TRANSFER PROFILE. WELDING

Abt Associates Incorporated. Donald M. Murray. September 1971. 62 pages.

N72–13417

Welding was selected for a major role in the fabrication of U.S. space vehicles because of its advantages with respect to cost effectiveness and material weight, strength, and volume. The National Aeronautics and Space Administration found it necessary to refine and develop welding techniques whereby all the advantages of welding could be exploited and welds of consistently high quality could be achieved. The program generated numerous specific innovations, many of which have found subsequent application in other segments of industry, where the impact of NASA's welding achievements is beginning to be felt. The report provides an overview of these achievements and describes the ways some of them have general industrial utilization.

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FASTENERS AND FASTENING TECHNIQUES: A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1972. 22 pages.

N72–16333

A number of fastening methods, devices, and techniques which were developed as a result of aerospace research have potential applications in other industries. This document describes some of these. The first section includes a selected group of fasteners and concepts for fasteners such as locking devices, couplings, and connect and release mechanisms. The second section discusses a number of fastening techniques such as those for mounting panel lamps, clamping flange bolts, and stretching fasteners. No patent action is contemplated on most of the technology described. A form is provided for requesting additional technical information on individual devices and techniques.

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THE BEHAVIOR AND DESIGN OF BOLTED SHINGLE SPLICES

Lehigh University, Fritz Engineering Laboratory. Edward H. Power, and John W. Fisher. May 1971. 67 pages.

PB–206 519

Shingle joints have been used extensively in heavy tension members, such as those found in bridges, buildings, and other steel structures, to reduce the amount of splice material. These joints are generally designed by methods developed for riveted joints. When the use of high strength bolts is considered, friction type bolted joints are often used. These joints do not take full advantage of the high shear strength of the bolts. This document describes the results of a series of analytical studies and a complementary test program that examined the behavior and ultimate strength of bolted shingle splices. These results show that such splices do not need to be designed as friction joints. A preferred method of design is presented which provides better correlation with the measured plate forces and observed fastener forces than existing design methods.

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Building Technology

SHEAR STIFFNESS OF TWO-INCH WOOD DECKS FOR ROOF SYSTEMS

U.S. Department of Agriculture, Forest Products Laboratory. John J. Zahn. 1972. 22 pages.

AD–740 356

The lateral stability of beam and deck systems depend in part on the shear stiffness of the attached deck. Because of the need for data on shear stiffness, experiments have been made on 2-inch lumber decks and ½-inch plywood decks. The report deals with shear stiffness of a roof deck attached to deep roof beams, a system often counted upon to prevent lateral buckling under design load but deemed unduly conservative and wasteful of material with deck stiffness neglected. If the deck stiffness exceeds a certain threshold value, the stability criterion is stated to no longer govern the design of the structure. Therefore 2-inch decking is of particular interest, because of its low shear stiffness, to laminators, structural engineers, architects, and building officials. It was found that the shear stiffness of 2-inch decking is about one-eighth as great as that of nailed ½-inch plywood, independent of layup. Means of computing shear stiffness of both nailed and glued decks are described.

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CONDENSATION PROBLEMS: THEIR PREVENTION AND SOLUTION

U.S. Department of Agriculture, Forest Products Laboratory. 1972. 38 pages.

AD–741 502

The movement of water vapor through the walls and ceilings of a home is an important factor in house maintenance, such as the need for periodic repainting. In cold weather, particularly, excessive moisture and condensation unless prevented can lead to excessive costs. Proper vapor barriers, however, used in conjection with efficient insulation and adequate ventilation can serve to avoid much difficulty. The report shows how to control condensation and to minimize problems by the proper utilization of such methods. Other construction details are also described and illustrated, with indications for good maintenance cost reduction.

PERFORMANCE CONCEPTS IN BUILDINGS. VOLUME 1: INVITED PAPERS

National Bureau of Standards, Institute for Applied Technology. Bruce E. Foster (Editor). February 1972. 819 pages.

COM-72-10309

This document is comprised of 82 papers presented at a symposium, held in Philadelphia, Pa., 2–5 May 1972, jointly sponsored by the International Union of Testing and Research Laboratories for Materials and Structures, the American Society for Testing and Materials, and the International Council for Building Research Studies and Documentation. The subject matter covered in the papers includes: Physiological, anthropometrical, psychological, sociological, and economic human requirements and methods for their evaluation; physical requirements and methods of evaluation in mechanical, acoustical, thermal, dimensional stability, compatibility, fire properties, and geometry areas; operation and maintenance requirements and methods of evaluation in such areas as maintenance, repair, replacement, and versatility; techniques and problems in applying the performance concept to design; and experience gained in application of the performance concept in design, building, and building use.

A PROPOSED URBAN DEVELOPMENT PROGRAM FOR TEGUCIGALPA, HONDURAS

Department of Housing and Urban Development, Division of International Affairs. August 1967. 134 pages.

PB-188 851

A basic and pressing problem facing every developing country is how to cope with the unprecedented growth of urban areas. Effective local and regional planning, adequate land-use controls, essential municipal services, and housing are all urgent, high-priority needs. This report provides an example of an urban development study which was undertaken for Tegucigalpa, Honduras. The study proposals for a planning program which focuses attention on public policy, citizen participation, institution building, development of Government of Honduras staff capability, public administration, and public finance. The recommended program would enable Tegucigalpa to serve as a "model city" for development throughout the country. The program is designed to provide for the involvement of the city's inhabitants.

EARTH FOR HOMES

Department of Housing and Urban Development, Division of International Affairs. May 1969. 79 pages.

PB–188 918

The introduction of earth as a home building material into areas where it has never been used before and its reintroduction and improvement where it had fallen in ill-repute and disuse, has resulted in a revival of earth home construction, as evidenced by its widespread use, for instance in Australia where over 9000 earth wall houses were recorded as far back as 1933; in India where 4000 permanent earth homes for displaced persons were built in the year 1947; in the southwestern portions of the United States of America where stabilized adobe is popular; and in emergency programs in Korea and Taiwan, among others. The revival has received added impetus through common sense use of aided self-help, whereby the heretofore unused time of the ill-housed—the greatest resource of all—bolstered by aid in the form of technical know-how, minor loans, provision of small amounts of heretofore unobtainable materials, and the like, make it possible for man to build much better shelter for himself than he ever could produce unaided—all within available resources. This manual is directed to those who wish to become informed on the uses of earth and to perhaps investigate its possibilities under conditions with which they are intimately concerned. The general topics include: Methods of earth wall construction; stabilization of earth by admixtures; earth floors; earth roofs; wall finishes; design of earth walls.

BAMBOO AS A BUILDING MATERIAL

U.S. Department of Agriculture, Foreign Agriculture Service (reissued by Department of Housing and Urban Development, Division of International Affairs). May 1953 (reissued June 1967). 58 pages.

PB–188 921

This document is intended as a guide for use of those actively engaged or interested in the development or improvement of the use of bamboo as a construction material. The topics covered include: Parts of a house for which bamboos are suitable; bamboo reinforcement of concrete; geographical distribution of bamboos; differences among species; some bamboo species used in housing; shortcomings of bamboo and how to overcome them; preservation; skill requirements; tool requirements; differentiation and evaluation of species; collecting specimens for identification.

PROPOSED MINIMUM STANDARDS FOR PERMANENT LOW-COST HOUSING AND FOR THE IMPROVEMENT OF EXISTING SUBSTANDARD AREAS

Department of Housing and Urban Development, Division of International Affairs. May 1966. 107 pages.

PB–188 923

This document provides a set of proposed minimum housing standards which are based, principally, on codes, ordinances, and standards obtained from countries in Latin America and the Carribbean Area, and on discussions with officials and technicians in these areas. Insofar as possible, they are based on performance requirements rather than on specifications and could contribute significantly to lower construction and housing costs. The standards are intended to provide: An aid to designers, developers, or sponsors of housing projects, giving them a "floor" upon which to base their plans, specifications and cost estimates; and a yardstick to measure the acceptibility of housing projects proposed for financial and/or technical assistance from any source, local or foreign. They may also serve as a basic standard which could be useful to those countries interested in modifying existing codes or by-laws governing housing design and construction, or which could be adopted, with modifications, by urban communities which, at this time, do not have housing or building codes, ordinances, or standards.

PHYSIOLOGICAL OBJECTIVES IN HOT WEATHER HOUSING. AN INTRODUCTION TO HOT WEATHER HOUSING DESIGN. (REVISED EDITION)

Department of Housing and Urban Development, Division of International Affairs. Douglas H. K. Lee. 1963 (reissued June 1969). 83 pages.

PB–188 925

This document was prepared in order to provide a simple description of the basic physiological principles which should be observed in the design and planning of housing for hot climates. It is intended for use in connection with shelter improvement work in underdeveloped countries. Experience has shown that much of the misunderstanding which exists on the utilization of housing as a protection against climatic stress stems from an incomplete realization of what makes up weather and climate, coupled with an incomplete understanding of the way in which climatic elements may act upon man to produce certain undesirable effects. To ensure that the principles themselves shall be understandable and appear for what they are—logical deductions from present knowledge—their enunciation is preceded by a simplified analysis of tropical and subtropical climates, and by an explanation of the way in which they act upon man. Principles of housing are first developed in some detail for a typical hot dry environment;

and then those applicable to a typical warm humid environment are presented in contrast. Finally, modifications of these basic principles to meet more common combinations of climatic types and certain special cases are discussed.

PALMS–THEIR USE IN BUILDING (REVISED EDITION)

Department of Housing and Urban Development, Division of International Affairs. Miriam L. Bombard. February 1964 (reissued June 1969). 28 pages.

PB–188 928

Houses built only with materials obtained from palms are commonplace in many parts of the world. Framework, floors, walls, roofs, gutters and closures for door and window openings may all be made from palms with simple tools and equipment. The resulting structures are often eminently suitable for tropical housing. For example, despite some shortcomings, palm thatch can assure more comfortable living quarters than many other readily available building materials. This publication summarizes pertinent information on the uses of palms in building houses. The subject areas covered include: Structural members for which palms have proved suitable; wall and floor coverings; distribution of palms and the extent of their use; characteristics of the various species of palms and specific uses; distinctive structure of palms; uses other than as building materials.

PROBABILISTIC ELEMENTS OF COST ESTIMATING FOR BUILDINGS

Massachusetts Institute of Technology, Department of Civil Engineering. Rodney J. Alberts. February 1972. 90 pages.

PB–207 409

In theory, cost estimating is a simple process, consisting of determining what is to be costed, estimating unit prices and quantities, and finding the cost as the product of quantity times unit price. In practice, difficulty is encountered in the method of obtaining quantities and unit prices, and probabilities enter into the computations. The report covers methods of introducing probabilities in building costs estimation. The investigation includes the input required and means of handling to arrive at total cost distribution. Three methods are discussed: Assuming the total cost to be normally distributed and deriving the mean and variance of the distribution; performing a Monte Carlo simulation; and numerically evaluating a convolution integral.

THE HEEL JOINT OF TRUSSED RAFTERS

Virginia Polytechnic Institute and State University, Wood Research and Wood Construction Laboratory. E. George Stern. March 1971. 12 pages.

PB-207 806

The heel joint between the diagonal and horizontal beams of a trussed rafter has become more critical in rafter design with the reduction of standard dimensions for lumber from 1⅝×3⅝ to 1½×3½ inches, since improvements in heel joint design may do much to compensate for the reduced size. The document is especially concerned with the connector-plate assembled heel joint and its improvement by increased rigidity, fulcrum relocation, and transmission of moment forces effectively from the upper chord to the lower chord. Four types of heel joints for trussed rafters assembled with 2×4 lumber with and without stiffening struts or wedges are discussed, along with the proper types of plywood, nails, and steel plates.

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WOOD IN THE CONSTRUCTION OF MASS-PRODUCED HOUSES

Virginia Polytechnic Institute and State University. Geza Ifju, and E. George Stern. August 1971. 28 pages.

PB-207 812

The immense demand for housing all over the world, especially in developing countries, can be met only if full advantage is taken of all materials and resources. One of the most important of these materials is wood, the only one which is almost universal and self-renewable. The report discusses the properties of wood which make it especially suitable for home construction, with particular attention to strength-weight relationships and durability. Recent developments are reviewed in the use of wood in prefabrication and mass production of low-cost houses, giving special reference to foundations. Bent foundation systems are described which consist of flitch beams and columns assembled by mass-production methods, using pressure treated standard lumber and steel flitch plates between this lumber.

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MASS-PRODUCED FOUNDATIONS FOR MASS-PRODUCED HOUSES: A PROGRESS REPORT

Virginia Polytechnic Institute and State University. Joseph M. Cidras, Viswanath K. Kumar, and E. George Stern. September 1971. 44 pages.

PB-207 818

Efficient production and erection of mass-produced houses require their placement on mass-produced foundations that are easily installed under any conditions at minimum cost. A feasibility study is reported of foundation bents, made of pressure treated lumber and usually reinforced with steel flitch plates. The object is to evolve a system that is effective from structural, material, labor, assembly, handling, transporting and erecting viewpoints. The anchorage of such a foundation to the ground must also be convenient and simple. The overall guidelines for the design of the proposed system are provided. Its applications and limitations are explored. The system appears promising from the environmental, economic, and engineering viewpoints.

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PROLONGING LIFE OF WOOD IN HOUSES

Department of Housing and Urban Development, Division of International Affairs. J. Robert Dodge. June 1967. 44 pages.

PB–210 129

Dwellings constructed entirely or in part of wood frequently deteriorate rapidly due to readily avoidable errors in the design of the structures and in the curing, use, or protection of the wood. This is especially true in the humid tropical areas with a high incidence of insect infestation. This document contains the most widely accepted information on the protection of wood. It is intended to serve as a reference and check list for housing technicians. The topics include: Sources of damage; protection against damage; wood preservatives; methods of treatment; soil poisons; air drying lumber; boilerless dry kilns; drying by solar radiation.

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CAMPUS DESIGN IN INDIA. EXPERIENCE OF A DEVELOPING NATION

Kansas State University. Achyut Kanvinde, and H. James Miller. November 1969. 164 pages.

PB–210 657

This document explores the problem of planning a smoothly functioning university campus capable of responding effectively to growth and development. It is intended primarily for the decision-makers of Indian higher education, but it may be of interest to university authorities and planner-architects in general. The first sections deal with the philosophy of higher education, and explain how a properly designed campus is essential to a successfully functioning university. Results are then provided of studies of campus designs in India, as well as in other countries. Faults in existing systems of organizing construction are examined, and the desiderata of an appropriate system are indicated. The procedure for success in campus development is set out in great detail.

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Civil Engineering

EMBANKMENT PORE PRESSURES DURING CONSTRUCTION

U.S. Army Engineer Waterways Experiment Station. G. W. Clough, and J. W. Snyder. May 1966. 74 pages.

AD–735 842

Methods available to design engineers for predicting the development of pore pressures during the construction of earth dams are quite numerous but, unfortunately, few have proven reliable or have general application. This document summarizes observed pore pressure data in existing dams, as well as published methods of predicting and determining the development pore water pressure in earth dams. A summary of theoretical methods for predicting pore pressures is included, and a number of design considerations are recommended.

DEVELOPMENT OF A REPETITIVE EXPLOSION DEVICE FOR SOIL DISPLACEMENT

Southwest Research Institute. Charles D. Wood. December 1971. 73 pages.

AD–736 348

REDSOD (Repetitive Explosion Device for SOil Displacement) is a high-efficiency earthmoving concept. It consists, essentially, of one or more combustion chambers attached to a tractor. The chambers are charged with compressed air and gasoline. A spark plug ignites the charge and the exhaust gases are suddenly released against the face of the earth mass to be excavated. The violent expansion of these gases ruptures the soil and blows it clear, thus creating a crater. The tractor advances into the crater and repeats the cycle, and in this manner a trench is formed. This document provides a description of the design and development of the equipment used in the REDSOD system. It also reports the results of an investigation of the relationships between the dimensional and operating parameters of the system upon the size of the craters produced in various soil types.

A THEORETICAL METHOD FOR EVALUATING STABILITY OF OPENINGS IN ROCK

Woodward-Lundgren and Associates. Chin-Yung Chang and Keshaven Nair. April 1972. 147 pages.

AD–740 341

The development of theoretically sound methods for designing excavation in rock is significant because of the increased use of underground facilities in urban and other engineering applications. A major factor is the evaluation of the structural stability of an opening. Recently a new technology has been introduced, located primarily in numerical procedure, which has the potential of predicting with improved accuracy the mechanical state of a rock mass. A model of the response of certain classes of joints, cracks, and fissures, the inability of rocks to withstand tension, localized yielding of rock due to stress concentrations, and the time-dependent or creep response of rock is presented. The report considers two phases of investigation: development of computational methods which model rock mass features, and analysis of case histories with comparison of predicted and measured performance. An example of actual operation gives data for several rock types; biotite and mica schist, quartz-mica, quartzite, and pegmatite.

FUNCTIONAL CLASSIFICATION OF GOUGE MATERIALS FROM SEAMS AND FAULTS IN RELATION TO STABILITY PROBLEMS IN UNDERGROUND OPENINGS

University of California (Berkeley), Department of Civil Engineering. T. L. Brekke, and T. R. Howard. February 1972. 79 pages.

AD–740 807

Although knowledge of rock mass behavior is at present relatively poor and erratic, the construction of tunnels and other underground openings requires quantitative decisions regarding excavation procedure as well as the type and amount of reinforcement or support and lining. The choice of correct methods and procedures for driving openings through faults and seams has proven to be among the most difficult assessments. Among the factors that strongly influence the outcome are the properties and behavior of the gouge materials in these discontinuities. This document represents the first phase of an effort to develop a functional classification system for such materials. It provides the results of an extensive literature search on the subject, of on-site case studies, and of laboratory investigations. Some major characteristics of gouge material are discussed, as in the classification of rock masses in general and discontinuities in particular. A tentative classification of gouge material is presented. The potential behavior of the different types is listed, pertinent properties and parameters to be assessed or measured are identified, and all factors that will influence the actual behavior are enumerated.

ENGINEERING CLASSIFICATION OF IN-SITU ROCK

University of Illinois, Department of Civil Engineering. Don U. Deere, Andrew H. Merritt, and Richard F. Coon. January 1969. 290 pages.

AD–848 798

The engineering properties of soil and rock are important factors in nearly every civil engineering project. Generally, however, the engineering properties of a rock mass cannot be predicted with the precision of those of soils. There are no widely accepted index properties which correlate with the engineering properties of the rock mass, and the number of rock behavior measurements which quantitatively define the in-situ engineering properties of rock has been rather limited. An engineering classification for in-situ rock is now proposed which is based on the results of field exploration and laboratory testing. The rock types investigated included granite, basalt, gneiss, schist, sandstone, limestone, and siltstone. The application of the proposed classification is shown by comparing rock quality measurements with other engineering data.

FEASIBILITY OF UTILITY TUNNELS IN URBAN AREAS. A COMPREHENSIVE EXAMINATION OF THE TECHNICAL, LEGAL, AND ECONOMIC ASPECTS OF PLACING URBAN UTILITIES IN TUNNEL STRUCTURES

American Public Works Association, and Stanford Research Institute. March 1971. 168 pages.

PB–207 223

Urban public utility systems, traditionally located in street rights of way in order to minimize costs and to serve customers located near these streets, present problems of traffic disruption and municipal confusion when excavations must be made for repair or new installations. The report considers the feasibility of using utility tunnels, especially in conjunction with transportation facilities, to contain all utility systems, thereby eliminating the necessity for periodic excavation. Examples are noted of successful operation of such tunnels in cities outside the U.S. The discussion includes water lines, sewer service, gas service, and electric service. Tunnel types are described with application to rapid transit subways and depressed freeways. Three types of demonstration projects are recommended.

COMPUTERIZED SLOPE STABILITY: THE SLIDING BLOCK PROBLEM; STEADY AND TRANSIENT STATE FLOW CONDITIONS

Purdue University, Water Resources Research Center. Carlos Mendez, M. B. Roy, and C. W. Lovell, Jr., Editor. February 1972. 63 pages.

PB–207 666

The report deals with determination of the stability of reservoir banks and slopes. Research is directed to development of a computer assisted system of stability analysis of slopes containing soil strata of varying strengths. The computer program as formulated includes accommodation for a three-slope ground surface, a two-soil profile for a relatively strong soil underlain by a relatively weak one, both uniform and concentrated vertical external boundary loadings, and a three-slope sliding surface with its central slope located in the weaker layer. Summation of forces leads tc simultaneous equations adequate to solve for the factor of safety. Active and passive routines are developed, and a sliding block model is discussed. Presence and movement of ground water is considered.

EARTHQUAKES RELATED TO RESERVOIR FILLING

National Research Council, Division of Earth Sciences. January 1972. 30 pages.

PB-208 327

There is evidence that local seismic activity, including earthquakes of moderate magnitude, has occurred in association with the impounding of water in large reservoirs in several countries. In at least three instances such earthquakes have had quite serious, even disastrous, effects—at Koyna Reservoir in India, at Kremasta Lake in Greece, and at Lake Kariba in the Zambia-Rhodesia boundary region. This report summarizes the history of recorded correlations between seismic activity and the filling of large reservoirs, discusses scientific considerations, and provides background for a series of recommendations on the subject. The recommendations involve a series of geologic, geodetic, and seismic studies aimed at a reduction of the hazard through a clearer understanding of its causes.

URBAN STORM RUNOFF AND COMBINED SEWER OVERFLOW POLLUTION

Envirogenics Company. December 1971. 204 pages.

PB-208 989

Whereas combined storm and sanitary sewers may provide adequate capacity to carry peak storm flows, sewage treatment facilities do not have the same hydraulic capacity. Therefore during periods of precipitation, the sewage treatment facility may be forced to divert a portion of the combined flow from the treatment plant and discharge directly into a receiving water body or watercourse. These overflows are of particular concern because they result in the bypass to the environment of untreated sewage and present a public health problem. This document provides a general method for ascertaining the extent of pollution occurring as a result of combined sewer overflows. It also provides detailed descriptions and costs of the various components comprising a system for abatement of water pollution from this source.

CONSTRUCTION TIME VS. CONSTRUCTION COST

Day and Zimmerman Consulting Services. February 1970. 42 pages.

PB-210 509

This document examines the relationship between construction cost and construction time for projects outside of the United States. Its objective is to provide guidelines illustrating the parameters of construction costs for different lengths of construction periods. Consideration is given to general aspects of construction time reduction, some potential techniques for construction schedule acceleration, and identifiable parameters which affect the cost of any construction project. Also included are the

Civil Engineering (continued)

results of an examination of construction costs vs. construction time of three specific highway projects in Africa, South America, and South Asia.

Computers

AUTOMATIC DESIGN

Auburn University, Department of Mechanical Engineering. William H. Bussell, Zia Ur Rahman, and Salim Khalid. December 1971. 379 pages.

AD–737 667

The use of computers as an aid in design is a logical engineering development which must follow the availability of the large memory and programmable logic of digital computers. Procedures utilizing computers in design have been under development for more than a decade, and will ultimately result in better and cheaper design. This report describes a design system concept for machines in which a force of motion transformation is involved. The basis of the system is the design of mechanisms, and utilizes preprogrammed methods. Thus mechanism synthesis, kinematic and force analyses, with schemes for parts configuration assignment, and development of dynamic characteristics are combined to develop an automatic mechanism design system. A scheme for the development of automatic component design is also described. Program listings and user instructions are included.

COMPUTERS AND ECONOMICS: PROGRESS, PROBLEMS, AND PROSPECTS

Rand Corporation. Charles Wolf, Jr., and John H. Enns. October 1971. 62 pages.

AD–737 680

Computers and computer technology have provided a bridge between the accumulated body of formal economic theory and the growing availability of large economic data bases. The result of this bridging function has been the growth of modern econometrics and an increasing policy orientation of economics. The first portion of this report reviews the extensive literature pertaining to the growth of computer use in economics during the past two decades. Consideration is then given to some of the principal current uses to which computer capacity and software are being applied most intensively, as well as trends for the future. Finally, some of the problems attendant to computer uses and accomplishments in economics are discussed, along with several methodological problems which have been intensified by the growth of computer capacity and access.

Environmental Technology

A SURVEY OF AUTOMOTIVE EMISSIONS

Naval Research Laboratory. L. B. Lockhart, A. W. Ali, and P. W. Mange. October 1971. 42 pages.

AD–738 799

The gasoline-powered automobile has been identified unequivocally as a major source of smog, or photo-chemical haze, that sometimes develops where large numbers of these vehicles are used. The conspicuousness of automotive emissions, the close association of man and the automobile, and the largely unknown effects of atmospheric pollutants on man and his environment have generated social and political pressures to curtail automotive pollution. This document summarizes the available information and theories pertaining to atmospheric pollutants derived from the operation of gasoline-powered vehicles, their behavior and ultimate fate in the atmosphere, and their biological effects.

A STUDY OF ENVIRONMENTAL MONITORING AND INFORMATION SYSTEMS

University of Iowa, Institute of Urban and Regional Research. James S. Gardner. January 1972. 292 pages.

AD–739 553

As the recognition, if not the magnitude, of environmental problems has become more acute, the need for various forms of environmental monitoring has been recognized. The need derives from a desire to learn what has happened, is happening, and is likely to happen to man's environment. The ability to satisfy these desires has been greatly enhanced by the development of automated data collection, storage, and processing. The major part of this report reviews the status of environmental information. First, the status of the collection of data by remote means is reviewed from the point of view of gathering data on variables pertinent to environmental description and monitoring. A description is then given of variables relating to the lithosphere, hydrosphere, atmosphere, and biosphere. A place for including description of human activities through land use classification is also considered. These reviews provide the basis for presenting the organizational structure for an environmental information system. The suggested task for this system is to monitor present environmental data collection activities, environmental research activities, and developing schemes for data collection and research.

ENVIRONMENTAL CONTROL SEMINAR PROCEEDINGS

U.S. Department of Commerce, Bureau of International Commerce. Daniel A. Okun, and Arthur C. Stern. September 1971. 308 pages.

COM–72–50078

These proceedings incorporate the papers presented at a series of Seminars on Environmental Control, with particular emphasis on technology and management of water and air pollution control, conducted in Rotterdam, Warsaw, Prague, and Bucharest during May and June 1971. Papers are included by both U.S. experts and experts from the host countries. Some of the topics covered include: The dedication to environmental management; perspectives on environmental control policy; the international cooperative effort to overcome environmental problems; incorporation of new pollution control technology in process design and control; evaluation of new water pollution control technology; a statistical model of the interdependence of river flow rate and pollution concentrations; new planning approaches to water pollution control; increased efficiency of water treatment by flocculants; approaches to prevention of water pollution; air pollution and its control; establishing the extent of air pollution control required; control of air pollution from combustion sources; control of industrial air pollution; status of instrumentation in air pollution control; impact of atmospheric conditions on the propagation of sulfur dioxide; perodic measurements of atmospheric pollution and their interpretation; dry ammonia process for sulfur oxide neutralization; basic criteria of the norms for maximum admissible pollutant concentrations in the atmosphere of town areas; action of atmospheric dust and gas pollutants on infectious processes; air pollution control on the working platforms of coal carbonization plants.

DOCUMENTS FOR THE U.N CONFERENCE ON THE HUMAN ENVIRONMENT, STOCKHOLM, JUNE 5-16, 1972

U.S. Department of State. March 1972. 696 pages.

PB–206 618–SET

This set of reports is comprised of the documentation prepared by the Secretariat of the United Nations Conference on the Human Environment for consideration by the nations attending the meeting which was held in Stockholm, Sweden, 5–16 June 1972. The conference was organized in recognition of the need for a common outlook and common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment. The individual reports of the set, which are described below, may also be purchased separately.

DOCUMENTS FOR THE U.N CONFERENCE ON THE HUMAN ENVIRONMENT, STOCKHOLM, JUNE 5-16, 1972. PART I

U.S. Department of State. March 1972. 137 pages.

PB–206 618–1

This first part of the Human Environment Conference documentation contains, in addition to the agenda and rules of procedure, a declaration on the human environment and an action plan for the human environment. The action plan, which forms the major portion of the report, reviews the background of the Conference and summarizes the preparatory processes and the principal premises and conclusions arising from it. It proposes a framework for environmental action into which the international recommendations considered in each of the six subject areas of the Conference may be integrated to form an action plan. The purpose of the action plan is to establish the basis for a concerted international attack on major specific environmental concerns and long-term objectives.

DOCUMENTS FOR THE U.N CONFERENCE ON THE HUMAN ENVIRONMENT, STOCKHOLM, JUNE 5-16, 1972. PART II

U.S. Department of State. March 1972. 401 pages.

PB–206 618–2

This second part of the Human Environment Conference documentation contains reports on each of the six subject areas of the Conference. These are entitled: Planning and management of human settlements for environmental quality; Environmental aspects of natural resource management; Identification and control of pollutants of broad international significance; Educational, informational, social, and cultural aspects of environmental issues; Economic development and environment; International organizational implications of action proposals.

DOCUMENTS FOR THE U.N CONFERENCE ON THE HUMAN ENVIRONMENT, STOCKHOLM, JUNE 5-16, 1972. PART III

Department of State. May 1972. 148 pages.

PB–206 618–3–1

This third part of the Human Environment Conference documentation contains a report by the U.N. Administrative Committee on Coordination and a bibliography of the source material from which the conference documents were drawn. The ACC report presents an overview of current activities of the United Nations system with respect to the human environment, and of the technical resources available within the system which can be utilized in the implementation of such program activities as are proposed by the Conference and agreed upon by the competent organs of the U.N. system.

AN ASSESSMENT OF NOISE CONCERN IN OTHER NATIONS. VOLUME I

Informatics, Incorporated. December 1971. 497 pages.

PB–206 721

The issue of noise and its effect on man has attracted worldwide attention. Many nations and their local governments have taken definite action and are supporting research toward noise abatement. This report presents a review of noise abatement and control problems and activities throughout the world. Noise in the community is first discussed as a broad spectrum issue. Sections

Environmental Technology (continued)

on aviation, surface traffic, and industrial noise deal essentially with the nature of the specific sources and with the experience gained in various countries in dealing with these noise sources. A section on noise in structures shows abatement measures taken in specific situations such as schools or hospitals, and reviews various national building codes and regulations. The relative relationships of various organizations which are active in the noise abatement field are identified and discussed. Finally, a presentation is given of the legal foundation upon which noise abatement and control action by various countries is based.

ABATEMENT OF NITROGEN OXIDES EMISSIONS FROM STATIONARY SOURCES

National Research Council, Committees on Pollution Abatement and Control. 1972. 63 pages.

PB–208 100

The nitrogen oxides emitted from industrial sources are essentially nitric oxide (NO) and nitrogen dioxide (NO_2), which are generally grouped together and termed NO_x. The reasons for concern about NO_x emissions to the atmosphere are threefold: (1) Both NO and NO_2 can of themselves have adverse health effects; (2) NO and NO_2 react with hydrocarbons in the atmosphere to generate eye irritants; and (3) both have detrimental effects on vegetation. This report of the *ad hoc* Panel on Abatement of Nitrogen Oxides Emissions from Stationary Sources provides an assessment of control technology for NO_x. The topics covered include: Sources of nitrogen oxides; formation and control of emissions from combustion sources; stack-gas cleaning; formation and control of emissions from chemical operations; sampling and analytical methods.

Highway Engineering

TFE EXPANSION BEARINGS FOR HIGHWAY BRIDGES

State of Illinois, Division of Highways. F. K. Jacobsen, and R. K. Taylor. June 1971. 87 pages.

PB–206 537

In certain cases the lack of durability or loss of performance of bridge expansion bearings under prolonged service has resulted in serious damage to the main structural components of a bridge. TFE (tetrafluoroethylene) has a number of characteristics, including an antistick surface, a low coefficient of friction, and chemical inertness, which make it an attractive candidate material for improved bearings of this type. The results of laboratory and comparative field tests, reported in this document, indicate that TFE is indeed superior to the bronze bearings currently used for abutment expansion bearings on concrete bridges. Design specifications are presented and recommendations are made for achieving the optimum TFE bearing configuration.

SELF-STRESSED SANDWICH BRIDGE DECKS

Virginia Highway Research Council. William Zuk, and Raghupati Sinha. November 1971. 39 pages.

PB–207 841

An entirely new type of sandwich panel is proposed for the construction of bridge decks, consisting of an unreinforced lightweight slab of expanding cement set between two thin plates of steel. The expanding core prestresses the panel. A report is made on laboratory tests which were conducted on the expansion characteristics of the concrete and the loading characteristics of ten small scale panels. Mathematical theories that were developed to predict the prestressing and the external load behavior of the panels are presented, along with tabular and graphic data.

SLOTTED CORRUGATED METAL PIPE DRAINS

State of California, Division of Highways. Eric F. Nordlin, J. R. Stoker, and B. G. Page. August 1971. 32 pages.

PB–207 933

The early collection and dissipation of all surface water on a traveled roadway is a problem that faces highway designers and hydraulic engineers. One method of intercepting surface water without the need for any form of a surface projecting inlet structure is the slotted corrugated metal pipe drain. This drain consists of 12 to 24 inch pipe, laid parallel to the roadway, which has a continuous longitudinal drain slot. The hydraulic potential of this type of drain is such that placement in shoulder areas is often desirable where cost is not excessive. In such a location, however, the drain pipe would be subjected to occasional heavy wheel loads, *e.g.*, from trucks which stop on the shoulder. This report provides a review of the development and performance of slotted corrugated metal pipe drains, and reports the results of full scale load tests to determine the feasibility of using these drains in occasional traffic bearing areas. Both 14–gage and 16–gage metal pipe, with proper back filling, was found to be capable of withstanding such loads. A number of design and placement recommendations are offered.

BALANCED STORM DRAINAGE (STORM DRAINS FOR ROADWAYS)

Kansas Water Resources Research Institute. John S. McNown, and Chia-Hsiung Tai. February 1972. 41 pages.

PB–208 024

Storm drains and their effective incorporation into the design of city streets are important because, among other reasons, their malfunction or overloading results in an impediment to traffic, and their clogging requires expensive maintenance. To balance the design of a drainage system, one must have an understanding of its various components. This document provides the results of laboratory examinations of the flow of storm water in street gutters and its interception by storm drains. Performance was observed for various inlet configurations, discharges, and slopes. The resultant data permit the evaluation of existing designs, and provide a basis for additional efforts toward increasing the interception abilities of drainage systems.

HIGHWAY AS ENVIRONMENT

Yale University, Department of City Planning. Christopher Tunnard. May 1971. 105 pages.

PB–208 077

As highway planning is in effect land planning, highway design can no longer be considered a simple engineering plan for vehicles. It becomes rather a conceptual process in the creation of a human environment which embraces not road users alone, but also those who live and work alongside the highway corridor. To test the interaction between highway users and their environment under actual driving conditions (vision in motion) a pilot research study was devised using en-route driver interviews and recall questionnaires. This identified most-seen areas and objects within the highway user's visual envelope. The practical application of general principles was then tested in case studies of four functionally different road types (both existing and proposed): limited access freeway, urban arterial, rural arterial with strip commercial development, and rural scenic secondary roads to be used primarily for recreational driving. Proposals were made for design changes, incentives and controls which would benefit both highway users and neighbors. But the major aim of this study was to formulate techniques of analysis. It is not intended to offer a set of standards for universal and automatic application. To explain and test new highway design proposals, in a manner equally comprehensible to highway engineers, local residents and motorists, apparatus was designed and constructed to simulate views of a proposed highway environment in physical model form. With this technique the proposed highway changes can be examined from the motorists's viewpoint as he drives along at 60 m.p.h. or from the viewpoint of a neighboring resident standing in his backyard.

EXPERIMENTAL STUDY OF REDUCING SCOUR AROUND BRIDGE PIERS USING PILES

South Dakota State University, and South Dakota Department of Highways. Fred M. Chang, and Mansour Karim. January 1972. 72 pages.

PB–208 387

Often, because of underestimation of the probable scour depth for a bridge pier foundation or because of unexpected changes in flow characteristics and in the river bed, the foundation soil around the pier may be scoured deeply below the foundation, ultimately resulting in the fall of the bridge. The bridge can be saved if proper protection measures are taken early. It has been found that circular piles installed upstream of piers will reduce scour by diverting flow. Submerged circular piles, when placed densely, also reduce scour depth at the nose of a pier aligned with flow. This protective measure has the advantage in that the piles may be installed even after construction of the pier is completed. Thus, for existing piers where sizeable scour holes are developing, the method can be used to reduce the scour and save the bridge. Installation of protective piles is economical and permanent in the sense that no maintenance is needed unless there is an abrupt change in the riverbed or flow characteristics.

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PERFORMANCE OF SINGLE AND DOUBLE SILLS FOR STEEP CIRCULAR CULVERTS

University of Texas at Austin, Center for Highway Research. Manam V. P. Rao, Robert J. Brandes, and Frank D. Masch. January 1971. 143 pages.

PB–208 408

The prediction of the hydraulic performance of culverts on moderate to steep slopes and the subsequent dissipation of energy at the culvert outlets are essential parts of the design of highway cross drainage systems. A satisfactory design must provide an adequate opening to pass flows without excessive build-up of water at the culvert inlet and at the same time insure a safe and even velocity distribution at the end of the downstream wing walls as a safeguard against scour. A design which meets these requirements should lead to minimum maintenance costs and efficient operation over a broad range of flows. This report provides the results of studies of the performance of single and double sills as a means of approaching these requirements.

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DEVELOPMENT OF A RATING SYSTEM TO DETERMINE THE NEED FOR RESURFACING PAVEMENTS

Minnesota Department of Highways, Research and Standards Division. P. C. Hughes. 1971. 100 pages.

PB–208 508

A study is described which was aimed to develop a system to aid in determining the need for pavement resurfacing. A new electromechanical device was developed for determining pavement rideability. Mounted in a passenger car at normal speeds, it records vertical movements of the car body with respect to the differential housing. A second and visual rating is made for concrete spalled or faulted joints, cracked and faulted panels, patched or overlaid panels, and scaling of surface; for bituminous, transverse, longitudinal, multiple and alligator cracking, rutting, and patching. These ratings are averaged to get the desired condition rating.

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DESIGN ASPECTS AND PERFORMANCE CHARACTERISTICS OF RADIAL FLOW ENERGY DISSIPATORS

University of Texas at Austin, Center for Highway Research. Khosrow Meshgin, and Walter L. Moore. February 1971. 161 pages.

PB–208 516

Drainage culverts under highways are a major source of maintenance expense in some areas due to the frequent occurrence of scour and erosion in the vicinity of the culvert outlet. The high flow velocities resulting from the hydraulic characteristics of a culvert are most damaging just downstream from the culvert and the erosion potential at this point is a feature to be considered in culvert design. A dissipator has now been developed which uses basic physical principles in a new way to cause the flow from a relatively narrow culvert to spread in width as it passes through the structure. The flow can be released at a depth and width corresponding closely with that of the downstream channel. This greatly reduces the potential for concentrated local scour. The stilling basin contains no obstructions which might catch debris or drift and clog the structure. The document contains the results of performance measurements of the dissipator, and general concepts and procedures are described for determining the geometric design of the structure.

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Industrial Engineering

COST EFFECTIVENESS ANALYSIS

Defense Documentation Center. March 1972. 346 pages.

AD–738 800

This bibliography is comprised of over 240 abstracts of reports which have resulted from U.S. Government-funded research on or involving cost effectiveness analysis. The time period covered is approximately 1968 through 1971. The subject matter includes cost effectiveness studies related to program evaluations, management techniques, research and development, design tradeoffs, related cost analysis and methodology, and systems value engineering. Corporate author, personal author, subject, and title indexes are included. The reports listed are available from NTIS.

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A GENERAL PROCEDURE FOR MAINTAINABILITY PREDICTION

Texas A and M University, Industrial Engineering Department. Gary L. Lind. April 1968. 50 pages.

AD–738 949

The paper presents a technique for the determination of certain equipment maintainability parameters by using a computerized time summation process. This procedure employs historical data whenever possible, along with subjective evaluation and expert judgment to predict the time equipment can be expected to be inoperable due to corrective and preventive maintenance. Because of the nature of the time summation process, this procedure is applicable to any type of equipment.

THE REPAIR POLICY DECISION–GUIDELINES WITH COST MODELING TECHNIQUE

Texas A and M University, Industrial Engineering Department. Brian P. Carman. May 1971. 60 pages.

AD–739 471

This paper develops guidelines for equipment repair policy decisions. For a cost-based decision, the technique described develops a support model from which costs peculiar to each policy can be identified and incorporated into a cost equation. Statistical methods to determine the significance of cost differences between alternatives are considered. In order that the paper be as widely applicable as possible, a general development of the cost equation is followed to the extent feasible. Thus, a specific cost model could be developed for any repair alternative.

CRITERIA FOR VALUE ENGINEERING

RCA Service Company. R. E. Purvis, and H. R. Barton. February 1967. 270 pages.

AD–809 656

Value engineering had its birth in the commercial world, where it has continued to be aggressively and beneficially applied. This report attempts to conceptualize value engineering analysis as a systematic quantitative technique embodying a formal mathematical structure which permits optimization of value. The mathematical modeling technique employed is in the form of and cost difference equation, which permits the evaluation of design-support alternatives and identification and selection of the least-cost alternative from among those originally considered. The mathematical model operates on quantitative, reliability, maintainability, operational readiness, and acquisition and support cost factor inputs. Hence, by selection of the least-cost alternative, a margin of assurance is provided that performance parameter requirements, as well as function and total cost, have been evaluated.

Machinery and Equipment

A REVIEW OF RESEARCH IN THE FIELD OF GAS-LUBRICATED BEARINGS

Franklin Institute Research Laboratories. Dudley D. Fuller. March 1970. 71 pages.

AD–703 648

Gas-lubricated bearings, as the name implies, uses a gaseous-state lublicant (often atmospheric air) in place of the usual liquid lubricant. This review points out some of the problems, summarizes some of the accomplishments, and then considers some of the future prospects in the field of gas lubricated bearings. The specific topics covered include: Plain journal bearings, attitude angle, grooved bearings, tilting-pad journal bearings, instabilities, rotor dynamics, vapor lubrication, externally-pressurized bearings, air-hammer instability, precision manufacture, mechanical design, compliant surface bearings, foil bearings, thrust bearings, squeeze film bearings. Descriptions are given of applications in the fields of medicine, navigation, manufacturing, general industry, power generation, computer industry, and transportation.

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A NEW COOLING TECHNIQUE FOR METAL-CUTTING TOOLS

University of Cincinnati, Department of Mechanical Engineering. N. P. Jeffries, R. D. Zerkle, and P. A. Marks. October 1969. 89 pages.

AD–740 173

The desire for increased productivity in many industries leads to higher operating speeds for the machines used in those industries. In the case of metal cutting tools, higher speeds and feeds and larger depths of cut generally result in higher temperatures in the cutting tools. This condition usually reduces the useful life of these tools, which in turn causes increased tooling costs and more down-time for the machines. The usual method of cooling by flooding the cutting region with a coolant is, in many cases, not very effective. This report describes a new cooling method which involves introducing a cooling liquid internally through the tool shank and supplying it, by the capillary action of a woven metal wick, to the underside of a cutting insert. There the liquid removes heat by vaporization and then escapes as a vapor. Tests indicate that a considerable temperature reduction may be obtained by this system under most practical cutting conditions. Further, the data indicate that flank wear can be decreased and tool life increased by the method.

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ALUMINUM WIRE TABLES

National Bureau of Standards. C. Peterson, J. L. Thomas, and H. Cook. February 1972. 66 pages.

COM–72–50183

During the first half of this century the predominant use of aluminum wire was for industrial and power station bus and overhead transmission conductors. Subsequent use in other areas, such as distribution, building wire, power cable, communication cables, and utilization items such as magnet wire, has made it desirable to present design information to the engineering profession. This document contains data on the conductivities and resistivities of both solid and stranded wires of various sizes and composition, together with a variety of other data of interest to the designer of electrical equipment and installations. Values are expressed in both U.S. Customary and International System (SI) Units.

AIR-BEARING SLIDES FOR PRECISION X-Y TURNING MACHINES

Union Carbide Corporation. W. H. Rasnick. March 1972. 24 pages.

Y–1824

Precision X-Y turning machines require slideways that provide straight, accurate, frictionless carriage movements. These machines now use roller bearings for the slides. The desired straightness of travel is difficult to obtain, particularly with respect to the short-wavelength variations in this straightness. Air-bearing slides have the potential of improving this condition significantly. In addition to the advantages of negligible friction, zero wear, and a straighter travel, the air bearing can withstand a greater shock loading than a roller bearing without damaging the ways. Three factors provide this advantage: (1) a larger bearing area, (2) the presence of a fluid squeeze film, and (3) the low compressive strength of the graphite pad compared to the cast iron ways. Performance tests, described in this report, indicate that air bearings meet design and experience predictions. An evaluation based on the results of tool-path accuracy tests, machined test parts, and abnormal operating experience show improved performance and maintainability.

Manufacturing Methods

SHOT PEENING FOR IMPROVED FATIGUE PROPERTIES AND STRESS-CORROSION RESISTANCE

Battelle Columbus Laboratories, Metals and Ceramics Information Center. J. E. Campbell. December 1971. 55 pages.

AD–735 409

Shot peening procedures developed over the past 40 years have resulted in substantial improvements in fatigue properties and stress corrosion resistance of high-strength alloys. These improvements have been observed in shot-peened specimens and components of high-strength steels, aluminum alloys, titanium alloys, and other engineering alloys. This report is intended to provide background information on peening for those who are concerned with obtaining maximum performance from highly-stressed components. It contains information on peening procedures that have been used in processing specimens and components to obtain such performance levels. Certain precautions are pointed out that should be observed in order to obtain the improved properties that have been attributed to the peening process.

WOOD PALLET MANUFACTURING

U.S. Department of Agriculture, Forest Products Laboratories. 1971. 38 pages.

AD–736 268

An extensive pallet industry has become established as a result of the rapidly expanding use of mechanical handling equipment. Unitized loads of industrial and agricultural products are handled by a variety of mechanical handling equipment such as lift trucks, racks, conveyors, slings, booms, and stackers. Pallets provide one of the foundations upon which to assemble these loads. Advantages of palletization are many and varied, but of a magnitude that makes their production from low-grade lumber economically feasible. This report is intended to be a reference for the industry, particularly for those who desire to provide design services, and buyers who desire to purchase quality goods. Information is included on properties of both hardwoods and softwoods, as well as comments about fastener systems as related to pallet production and design. Some discussion is included regarding wood pallet plant operation, economics, and layouts.

A MANUFACTURING PROGRAM FOR THE ELECTROSLAG MELTING AND CASTING OF MATERIALS

Mellon Institute of Carnegie-Mellon University. G. K. Bhat. July 1971. 339 pages.

AD–736 785

It has been claimed by those who use the electroslag remelting process, that manufacturing economies have resulted without sacrifice in the quality and reliability of the product. Also, this process offers a better alternative for the manufacture of square, rectangular (slab) ingots, hollow ingots and other simple shaped ingot products. A manufacturing technology program was therefore initiated to verify the claims made for the ESR process and to adapt this technique for consumable remelting of round and slab ingots of ultra-high strength steels and superalloys. The program results fully substantiated the superiority claims made for the AC electroslag remelting process. The feasibility of directly converting electroslag slab ingots into plate and ring products through reduced numbers of mill operations was demonstrated. The manufacturing and material utilization economics claimed for this process were fully realized. Several innovations were made in the preparation of titanium sponge electrodes for remelting by the isostatic pressing method, and an extremely useful aspect of the electroslag remelting production technique relative to the manufacture of hollow ingots was optimized. It is felt that full utilization of this program accomplishments in the production of components should result in significant cost savings.

ENCAPSULATION: A BIBLIOGRAPHY

Defense Documentation Center. May 1972. 114 pages.

AD-740 990

Encapsulation, or enclosing a component with a protective envelope, is useful as a deterrent of corrosion or deterioration. An annotated bibliography is presented of reports resulting from U.S. Government funded research concerning encapsulation used to protect electronic circuits, insulate against moisture and heat, and preserve from spoilage. It includes lacquer film and thin film coatings, especially for capacitors and thermoelectric devices. Entries are also included on potting compounds, resins, plastics, foams, and embedding methods, along the processes for ultrasonic welding, electrodeposition, and vacuum degassing of encapsulants. Among the materials discussed for encapsulation are aerosols, fiber bundles, foods, wire rope, viruses, and irradiation experiments. Reports involving test and inspection methods are included, as well as those concerned with capsule preparation, analog computer aids, and microtechnology. The reports described in the bibliography are available from NTIS.

MACHINING MINIATURE PARTS AND MINIATURE FEATURES: A BIBLIOGRAPHY

Bendix Corporation, Kansas City Division. L. K. Gillespie. December 1971. 31 pages.

BDX-613-585

This bibliography lists 226 references on the subject of machining small precision components. The associates areas of handling and inspection are also covered. The majority of listings concern metal workpieces. An index by process and by material is included.

DEBURRING: A BIBLIOGRAPHY

Bendix Corporation, Kansas City Division. L. K. Gillespie. December 1971. 33 pages.

BDX-613-593

This bibliography lists 258 references on the subject of removing machine burrs and molding flash from piece parts. Some of the specific areas covered include: Electrochemical deburring, hot gas deburring, abrasive blasting, power brushing, ultrasonic deburring, extrude hone deburring, burr minimization or prevention, vibratory deburring, and barrel tumbling.

HIGH-VELOCITY METALWORKING. A SURVEY

Midwest Research Institute. Michael C. Noland, Howard M. Gadberry, John B. Loser, and Eldon C. Sneegas. 1967. 192 pages.

N67-26560

Perhaps the most significant metal-forming trend today is the replacement of mass by energy to shape the material. Aerospace requirements for forming large structures to precise tolerances without loss of physical properties have accelerated this trend. It is the purpose of this report to provide information on technical developments in this area which appear useful for general industrial application. The topics covered include electromagnet metalworking; electrohydraulic metalworking; pneumatic-mechanical metalworking; explosive metalworking; die design for high-velocity metalworking; material behavior at high strain rates; trends and prospects for high-velocity metalworking.

PLANT REQUIREMENTS FOR MANUFACTURE OF WALLBOARD

Department of Housing and Urban Development, Division of International Affairs. June 1967. 63 pages.

PB-210 507

The term "wallboard" is applied to those construction materials which may be made from one of several types of fibrous residues, including bagasse, cereal straws, and cornstalks. These sheets are used in many ways in building construction, and the raw materials of which they can be made are to be found all over the world. This document provides a guide for the establishment and operation of a wallboard manufacturing plant. The topics covered include: Principles of wallboard manufacturing; the manufacturing process; building requirements; materials requirements; equipment requirements; labor requirements; overhead rate; unit cost of manufacturing; capital requirements; sales revenue; and projected profit and loss. Detailed operation sheets are given for each major step in the manufacturing process.

SPUTTER COATING OF TITANIUM CARBIDE ON CUTTING TOOLS

Dow Chemical U.S.A., Rocky Flats Division. G. Mah, R. J. Wright, J. S. Chapin, and J. E. Fuller. February 1972. 11 pages.

RFP-1702

The coating of carbide tools with titanium carbide has greatly improved cutting, extruding, and stamping properties of the tools. Both the lubricity of the oxide film formed under working conditions, and the high hardness and thermal conductivity of TiC itself contribute to the superior properties obtained. However, the chemical vapor deposition process commonly used to obtain the coating has several undesirable features, such as hydrogen pick-up which may cause embrittlement of the substrate and the requirement of maintaining a substrate temperature of 900C to 1200C. A new sputtering process is described which avoids these deficiencies. The process takes 4 to 5 hours per cycle as compared to 8 to 10 hours for chemical vapor deposition.

THE VERTICAL HOLDING CAPACITY OF MARINE ANCHORS IN SAND AND CLAY SUBJECTED TO STATIC AND CYCLIC LOADING

University of Massachusetts, Department of Civil Engineering. Stanley M. Bemben, Michael Kupferman, and Edward H. Kalajian. November 1971. 267 pages.

AD–735 950

A major feature for an anchor to be used in an ocean anchorage system is the capability to resist either horizontal, vertical, or oscillatory forces or a combination thereof. In order to properly design and predict the response of marine anchors subjected to these loading conditions, the engineer must have sufficient knowledge of the interactions between the anchor system and the surrounding soil. This report provides data on the influence of different loading conditions on the vertical pullout capacity of marine anchors embedded in a saturated soil. The variables considered include static vs. cyclic loading, anchor parameters, soil properties, and depth of burial. The data largely pertain to a particular type of foundation anchor: the embedment anchor.

FOREIGN DEEP WATER PORT DEVELOPMENTS. A SELECTIVE OVERVIEW OF ECONOMICS, ENGINEERING, AND ENVIRONMENTAL FACTORS. VOLUME I

Arthur D. Little, Incorporated. Bertrand L. de Frondeville, James L. Goodier, Michael C. Huston, and Bruce M. Putnam. December 1971. 156 pages.

AD–736 340

FOREIGN DEEP WATER PORT DEVELOPMENTS. A SELECTIVE OVERVIEW OF ECONOMICS, ENGINEERING, AND ENVIRONMENTAL FACTORS. VOLUME II

Arthur D. Little, Incorporated. Bertrand L. de Frondeville, et al. December 1971. 317 pages.

AD–736 341

FOREIGN DEEP WATER PORT DEVELOPMENTS. A SELECTIVE OVERVIEW OF ECONOMICS, ENGINEERING, AND ENVIRONMENTAL FACTORS. VOLUME III

Arthur D. Little, Incorporated. Bertrand L. de Frondeville, et al. December 1971. 243 pages.

AD–736 342

The development during the middle–1960's of the supertanker for the world-wide movement of crude oil and the subsequent development of very large ore carriers has focused attention on the port development plans of the principal trading nations. Only a few nations have well located, natural harbors capable of accommodating super-size ships requiring 70 to 100 feet of water. Most nations have had to assess the value of deep-water ports in terms of the cost of development compared to the gains in transportation savings, and to the local and regional economic and social expansion often associated with large-scale port improvements. The trading nations of Europe, the Middle East and Asia have made a wide variety of approaches to the accommodation of deep-draft shipping, as have Canada and the West Indies. This report presents an analysis of selected non-U.S. harbors (and off-shore loading/unloading facilities), with emphasis on how the decision to deepen or enlarge ports was arrived at; the approaches considered and the actual adjustments made to accommodate deep-draft ships, including the difficulties met and solved in construction and operation; and the character of future plans. The social disruptions and environmental impact of port development are additional important factors considered. Volume I presents the overall findings of the analysis and the conclusions derived therefrom. Volume II contains detailed findings and conclusions for ports in France (Dunkirk, Le Havre), Belgium (Antwerp), and the Netherlands (Amsterdam, Rotterdam); Volume III similarly treats ports in the United Kingdom, Canada (Port Carter), Australia, Japan, the Persian Gulf, and Ireland (Bantry Bay).

MATERIALS HANDLING CONCEPT FOR OFF-LOADING CONTAINER SHIPS IN FORWARD OR REMOTE AREAS

Battelle Memorial Institute, Pacific Northwest Laboratories. January 1972. 84 pages.

AD–739 382

With the increasing number of containerships, there is a need for a method of unloading these ships at areas which lack conventional container gantry cranes. This report describes such a method. The concept employs a support ship which has a novel form of gantry crane. Advantages of this method include: A much lighter structure is required; the vertical relative motions between the crane and vessel are virtually eliminated; the innovative use of present techniques will save developmental time and cost; and the concept is rapidly deployable with capabilities to commence unloading containers from a moored containership within eight hours of initial arrival time. Data on unloading rates, structural concepts, geometric configurations and mooring problems are presented.

UNAIDED BREAKOUT OF PARTIALLY EMBEDDED OBJECTS FROM COHESIVE SEAFLOOR SOILS

Naval Civil Engineering Laboratory. H. J. Lee. February 1972. 56 pages.

AD–740 751

Objects either partially or completely embedded in soil often require forces greater than their own weight to dislodge them. This additional force is termed the breakout problem. In many types of underwater operations, such as salvage, rescue, and use of embedment anchors, it is desirable to be able to predict in advance the magnitudes of these breakout forces so that the elements of the operation can be selected and used appropriately. This document gives procedures for use by field engineers in predicting forces required to remove objects immediately and in estimating times required when lesser forces are applied. The accuracies of the procedures are comparable to those usually attainable with other time-dependent soil mechanics problems.

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SEALS FOR THE OCEAN ENVIRONMENT

Naval Undersea Research and Development Center. Leonard J. Martini. April 1972. 38 pages.

AD–741 210

The solution to any seal problem depends on three major and interrelated variables: The operating conditions or environment, the mechanical design of the seal gland, and the seal material to be installed in this gland to prevent passage of the fluid to be sealed. The various interrelationships of these variables account for the fact that there are so many different types of seals. This paper describes those types of seals that readily apply to the ocean environment, both at seal level and at ocean depths. Three general types are considered in detail: linear seals, dynamic seals (*e.g.*, rotary seals, reciprocating seals), and general sealants. In addition to the review material, results are given of tests made on several elastomeric seal flanges and grooves of various configurations, a theoretical discussion is presented of dynamic seal design related to seal function, and a more economical method of solving sealant problems for limited-depth applications is described.

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TRANSPORTALE BREAKWATERS–A SURVEY OF CONCEPTS

Naval Civil Engineering Laboratory. D. B. Jones. May 1971. 76 pages.

AD–887 841

Marine Engineering
(continued)

Transportable breakwaters (otherwise known as portable or mobile breakwaters) are structures which not only prevent high ocean waves from entering an area, but also which possess a degree of mobility. Ideally, such a breakwater can be readily transported over considerable distances, quickly installed at the destination, and removed without undue difficulty at a later time for reuse elsewhere. This report presents the results of a survey of existing concepts for wave barriers which possibly could be applied in a transportable breakwater. It deals primarily with the effectiveness of various configurations. Data on 106 specific configurations are presented along with a schematic sketch of each configuration.

Metrology

PHOTOGRAMMETRIC GAGING

Bendix Corporation, Kansas City Division. T. Matzkanin. June 1971. 121 pages.

BDX–613–547

Photogrammetric instruments and techniques have been used for many decades to make precise maps of the earth's surface. In recent years there has been considerable interest in applying these instruments and techniques to various close-range measurement problems, such as part inspection. This document provides the results of a study which was undertaken to investigate the advantages and limitations of photogrammetric methods for making dimensional measurements of manufactured parts. In the study, photogrammetric methods were used to make dimensional measurements on a selected test object, and the results were compared with measurements made by conventional inspection methods. The study showed that photogrammetric methods offer an attractive combination of accuracy, speed, and versatility, and thus may be advantageously used in many industrial inspection applications.

SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR COMMERCIAL WEIGHING AND MEASURING DEVICES– 4TH EDITION

National Bureau of Standards. November 1971. 222 pages.

COM–71–50614

This handbook is intended as a working tool of the weights and measures official, as well as the equipment manufacturer, installer, and repairman. In addition, it may serve as a guide for those concerned with establishing weights and measures requirements for commercial and law-enforcement equipment. Some of the areas covered by the handbook include: Scales, weights, liquid-measuring devices, measure-containers, graduates, linear measures, odometers, timing devices, and dry measures.

COAL MINE DUST STANDARDS OF THE UNITED STATES AND OTHER COUNTRIES

Bureau of Mines, Division of Coal Mine Health and Safety. Donald P. Schlick, G. G. Morgis, and David B. Booker. 1971. 30 pages.

PB–206 150

This document provides a review of current, accepted coal mine dust exposure standards of the United States, as well as available standards of other countries. The countries included are Australia, Belgium, Canada, Czechoslovakia, France, Germany, India, Italy, Japan, Netherlands, Poland, United Kingdom, and U.S.S.R. Several dust samplers are described and illustrated.

INDUSTRIAL ENGINEERING STUDY OF HAZARDS ASSOCIATED WITH UNDERGROUND COAL MINE PRODUCTION. VOLUME I. ANALYSIS OF UNDERGROUND HAZARDS AND FATAL ACCIDENTS

Theodore Barry Associates. December 1971. 314 pages.

PB–207 226

INDUSTRIAL ENGINEERING STUDY OF HAZARDS ASSOCIATED WITH UNDERGROUND COAL MINE PRODUCTION. VOLUME II. DATA AND CHARTS

Theodore Barry Associates. December 1971. 245 pages.

PB–207 227

Falls of roof, rib, and face account for approximately 60% of the fatalities in the underground bituminous coal mines (100 men/year). Haulage accidents, machinery accidents, and explosions account for the majority of the remaining fatalities. Very little data are available on the relation between hazardous work elements in jobs and the flow process of jobs at typical faces in the industry. In addition, available fatality statistics are not normalized with respect to the total manhours of certain kinds of hazardous exposure in related jobs throughout the industry. All of these factors make it difficult to assess the significance of the conditions contributing to each fatality and to make recommendations that could reduce fatality frequency. It is for this reason that this industrial engineering study of all jobs related to underground coal mining was undertaken. The study focused on an analysis of coal mine accident data for the years 1966–1970. Twelve highly hazardous areas identified were the subjects of in-depth fatality reduction projects. Both general and specific recommendations are made.

A STUDY OF RADAR EXPLORATION OF COALBEDS

Teledyne Geotech. John C. Cook. June 1971. 84 pages.

PB-207 362

A study was undertaken to determine the feasibility of using V.H.F., short pulse radar for detecting underground obstructions in advance of coal mining. The detection of such obstructions, which include faults, clay veins, pyrite concentrations, and abandoned well casings, would improve the safety and efficiency of mining. An existing radar system was found to provide the basis of the most effective technique known for coal exploration. The results and experiences gained with the use of the system affirm the feasibility of using radar for exploration in advance of mining.

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DESIGN AND DEVELOPMENT OF HORIZONTAL BOREHOLE PACKERS FOR USE IN COAL BEDS

James H. Cobbs Engineering. December 1971. 31 pages.

PB-207 363

A new horizontal borehole packer for use in coalbeds has been designed which is less costly than existing commercial units, and which can be easily repaired in the field with inexpensive expendable parts. It employs a principle of operation which has not previously been used. This report describes the development and testing of the new packer, and provides an evaluation of commercially available units.

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COAL MINE RESCUE AND SURVIVAL SYSTEM. VOLUME I. SURVIVAL SUBSYSTEM

Westinghouse Electric Corporation. September 1971. 121 pages.

PB-208 266

In mine explosions, lethal gases are forced throughout the immediate area, the oxygen level is reduced, stoppings are destroyed, and normal ventilation is disrupted. While trying to escape after an explosion, miners are apt to encounter lethal gas. This document describes the design, operation, testing, demonstration and manufacture of a three component Survival Subsystem for use in such emergencies. The Personal Breathing Apparatus is a light, compact unit which may be carried by miners at all times, and which provides oxygen for a breathable atmosphere and a full head mask for protection from toxic gases. The Auxiliary Survival Chamber component is a transportable unit that is maintained close to actual working areas. It provides basic life support for 15 men for 14 days. The third component is the Large Central Chamber, which is conceived to be permanently installed in a central location in the mine and to provide life support for 50 men indefinitely.

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COAL MINE RESCUE AND SURVIVAL SYSTEM. VOLUME II. COMMUNICATIONS/LOCATION SUBSYSTEM

Westinghouse Electric Corporation. September 1971. 274 pages.

PB-208 267

Regular communication systems are often disabled or destroyed in mine explosions and other mine accidents. This report describes the design, fabrication, testing, and demonstration of a Communications/Location subsystem for use in such emergencies. An electro-magnetic component provides surface-to-miner communications, with a voice receiver in the survival chamber and on the miners' battery packs. A beacon transmitter in the survival chambers can transmit six pushbutton selected coded messages, thus enabling miners to respond to questions from the surface. A seismic signaller (thumper) is also provided as a backup to the electromagnetic component. Seismic reception and data processing facilities on the surface are the principal elements used to determine the location of the rescue drilling site.

COAL MINE RESCUE AND SURVIVAL SYSTEM. VOLUME III. RESCUE SUBSYSTEM

Westinghouse Electric Corporation. September 1971. 62 pages.

PB-208 268

Once miners trapped underground are located, it is the function of the Rescue Subsystem to complete a probe hole as soon as possible to their location through which their survival needs can be met until a rescue hole reaches them in a minimum of additional time. The entire operation must be carried out without creating additional hazards for the trapped men. The report describes the design, fabrication, operation, and demonstration of this Subsystem. It is comprised basically of two separate rotary type drilling rigs, along with their associated equipment. The probe hole is 8¾ inches in diameter and the other, through which a rescue basket is lowered to pull the miners to the surface, is 28½ inches in diameter.

Pipes and Valves

VALVE TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1971. 25 pages.

N72-12423

A number of valves developed by or for NASA have potential applications outside of the aerospace industry. The document describes a selection of valves that feature automatic response to various stimuli (thermal, electrical, fluid pressure, etc.), modified valves that have been changed by the addition or redesign of components, and special purpose valves that have limited application as presented but could lend themselves to other uses with minor modification. A form for requesting additional technical information is included.

Pipes and Valves
(continued)

PIPING AND TUBING TECHNOLOGY: A COMPILATION

National Aeronautics and Space Administration. 1971. 24 pages.

N72–13420

A number of piping and tubing devices developed by or for NASA have potential applications outside of the aerospace industry. The document describes the following devices: fittings, couplings, and connectors that have been useful in joining tubing and piping and various systems; devices used where flexibility and/or vibration damping are necessary; and devices found useful in the regulation and control of fluid flow. Also, shop hints to aid in maintenance and repair procedures such as cleaning, flaring and swaging of tubes are presented. A form for requesting additional technical information is included.

* * *

A TECHNIQUE FOR MAKING CLEAN HOLES IN METALLIC PIPING AND COMPONENTS

National Aeronautics and Space Administration, Lewis Research Center. Thomas P. Hecker. January 1972. 15 pages.

N72–14484

In many piping systems it often becomes necessary to install new instrumentation and/or auxiliary lines to the system after it has been assembled. A technique has now been developed for making access holes for such purposes which does not require the removal of a section of the pipe and which does not permit cutting oils, metal chips, or other contaminants to enter the pipe. The process can be done in the field with hand-held tools and a portable tungsten inert gas welding machine. Piping position and material do not affect the process adversely.

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Power Sources

WASTE HEAT UTILIZATION. PROCEEDINGS OF THE NATIONAL CONFERENCE, OCTOBER 27-29, 1971, GATLINGBURG, TENNESSEE

Electric Power Council on the Environment, and Oak Ridge National Laboratory (AEC). Marvin M. Yarosh (Editor). May 1972. 357 pages.

CONF–711031

In the generation of electrical energy, the end-product electricity represents no more than 40% of the total energy converted. The balance of the energy appears as waste heat and is discharged to receiving water bodies or to the air. This waste heat represents a potential resource that is only beginning to be tapped. In addition to engineering and technical considerations, its effective utilization involves marketing, regulation, legal, industrial, and financial problems. The document contains papers and discussions from a conference which brought together experts in all of the above disciplines. Some of the topics covered include: Use of waste heat in agriculture; thermal aquaculture; urban use of thermal energy from steam-electric plants; use of industrial process steam to reduce nuclear plant waste heat; legal problems in waste heat utilization; conflicts in utilization of heater water effluents from power plants in aquaculture; impact of waste heat on water quality standards; growing of marine animals on a commercial scale using heated seawater effluent; waste heat utilization in greenhouses and other agriculturally related projects; thermal energy and the 21st century; seafood marketing and economics; regulating thermal effluent; power plant siting and the use of heat; regulation of projects for beneficial uses of waste heat.

ENGINEERING FOR THE RESOLUTION OF THE ENERGY-ENVIRONMENT DILEMMA: A SUMMARY

National Academy of Engineering, Committee on Power Plant Siting. December 1971. 66 pages.

PB–206 326

Conflicts between those concerned with the quality of the environment and electric power utilities over power plant siting issues are examples of difficulties which can develop in the utilization of technology with changing value judgments regarding the side effects which accompany the benefits desired. This report summarizes a study which was undertaken to provide a factual basis for decision making in dealing with the complex problems associated with power plant siting. It proposes in broad outline a procedure of mitigating conflicts, which, if implemented, could become effective in the relatively near future. It also identifies research and development projects which could contribute to minimizing the conflict to a substantial degree. Finally, considerable information is included which is directly relevant to the energy-environment crisis and which, being previously unavailable in a single source, should be of value for future studies.

SURVEY OF ENERGY SUPPLY AND DEMAND IN THE REPUBLIC OF KOREA, 1966-1981

Battelle Memorial Institute, and Korea Institute of Science and Technology. C. H. Chilton, J. F. Fletcher, D. A. Gardner, et al. August 1968. 172 pages.

PB-210 319

The rapid general economic growth being experienced by the Republic of Korea has created an even more rapid growth in the demand for commercial forms of energy, with a result that there have been serious shortages of fuels and electricity. This report is the principal output of a survey which was undertaken to assist the government of the Republic in developing policy guidelines in the field of energy economics. It is essentially a forecast of the energy requirements of the economy through 1981, classified both by type of fuel and by major fuel-consuming sector. An important part of the study is an economic comparison of

Power Sources
(continued)

alternative sources of primary energy for power generation. A hypothetical program of power-plant construction through 1981 is presented, and this is translated into demands for primary energy sources. Finally, an effort is made to reconcile the demand forecasts with the supply outlook for each energy source.

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Resource Survey Technology

THIRD ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME I. GEOLOGY AND GEOGRAPHY

National Aeronautics and Space Administration. December 1970. 275 pages.

N72–12248

The document is comprised of papers pertaining to geology and geography which were submitted at a review of the NASA Earth Resources Program held at the Manned Spacecraft Center, Houston, in December 1970. Specific topics include: Census of Cities Project and Atlas of Urban and Regional Change; application of remote sensing techniques to selected inter and intra urban data acquisition problems; climatology of urban-regional systems; regional land use studies; application of remote sensing methods to coastal zone land use and marine resources management; linear geologic structure and mafic rock discrimination as determined from infrared data; thermal model for analysis of infrared images; passive microwave techniques applied to geologic problems; geologic terrain mapping from earth-satellite and ultra-high aerial photographs; remote sensing in marine geology; relationship between vegetation reflectance spectra and soil geochemistry.

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THIRD ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME II. AGRICULTURE, FORESTRY, AND SENSOR STUDIES

National Aeronautics and Space Administration. December 1970. 640 pages.

N72–12269

The document is comprised of papers pertaining to agriculture, forestry, and sensor studies which were submitted at a review of the NASA Earth Resources Program held at the Manned Spacecraft Center, Houston, in December 1970. Specific topics include: Automatic cartography techniques for earth resources research; spectral reflectance from plant canopies; aerial photography for sensing plant anomalies; remote sensing of soil limitations in agricultural areas; recognition of crops and soils by spot density measurements of imagery; thermal scanner for aiding irrigation scheduling; applications of remote sensing to corn blight detection and crop yield forecasting; significance of image resolution in a wildland area; identification and measurement of shrub-type vegetation on large scale photographs; vegetational inventory and ecological resource analysis from space and high-flight photography; remote detection of insect epidemics in conifers; multispectral sensing of moisture stress; classifying forest and nonforest land on space photographs; machine processing technology for earth resource survey; recent advances in radar applications to agriculture; interactive display/graphics systems for data analysis; phenomenological approach to scatterometer data interpretation.

THIRD ANNUAL EARTH RESOURCES PROGRAM REVIEW. VOLUME III. HYDROLOGY AND OCEANOGRAPHY

National Aeronautics and Space Administration. December 1970. 351 pages.

N72–12295

The document is comprised of papers pertaining to hydrology and oceanography which were submitted at a review of the NASA Earth Resources Program held at the Manned Spacecraft Center, Houston, in December 1970. Specific topics include: Detection and identification of benthic communities and shoreline features using multiband imagery; remote sensing for defining aquifers in glacial drift; measurement of plant community cover on infrared aerial photographs; management applications for thermal infrared imagery of lake processes; remote sensing of ocean color from aircraft; measurement of water depth by multispectral ratio techniques; radar monitoring of oil pollution; visible region remote spectroscopy of polluted water; whitecap coverage from aerial photography; use of a single blue band in oceanography; variation of radar cross section with wind; nanosecond radar observations of the ocean surface from a stable platform; passive microwave studies; integration of remote sensing data into global weather prediction, wave forecasting, and ocean circulation computer based systems.

MONITORING EARTH RESOURCES FROM AIRCRAFT AND SPACECRAFT

University of California (Berkeley), Forestry Remote Sensing Laboratory. Robert N. Colwell. 1971. 203 pages.

N72–18331

Man soon will be confronted by one of the most serious crises of his existence. Basically, this crisis is developing because the world's population is rapidly increasing at the very time when many of its natural resources have dwindled to a very low level. The supply-versus-demand problem is made even more serious by another recent development: Within the last decade there has been a tremendous increase in the per capita demand for Earth resources at virtually every economic level. This circumstance demands the wisest possible management of natural resources, at national, regional, and global levels. An important first step leading to such management is that of obtaining accurate resource

Resource Survey Technology (continued)

inventories, quickly and at frequent intervals. This report first describes an experiment that sought to determine the extent to which Earth resources might be monitored by means of periodic inventories made with the aid of aerial and space photography. It then presents the results obtained from that experiment in each of several geographic test areas. Special emphasis is given to vegetation resources for two reasons: (1) their intelligent management requires that they be monitored at frequent intervals, and (2) the economic benefits derivable from such monitoring of vegetation resources are potentially very great. Following the chapters in which the results obtained in various geographic areas have been reported, consideration is given to the potential value of such results to the resource manager. The final chapter summarizes the experimental results, both quantitatively and qualitatively. Then, on the basis of these results, conclusions are drawn as to the advantages, limitations, and overall feasibility of monitoring Earth resources with the aid of aerial and space photography.

THE APPLICATION OF GEOCHEMICAL, BOTANICAL, GEOPHYSICAL, AND REMOTE SENSING MINERAL PROSPECTING TECHNIQUES TO TROPICAL AREAS–STATE-OF-THE-ART AND NEEDED RESEARCH

U.S. Geological Survey. J. Van N. Dorr, II, D. B. Hoover, T. W. Offield, and H. T. Shaklette. December 1971. 103 pages.

PB–207 191

There is no geological reason why ore deposits should not be present in the tropical regions of the world as elsewhere; evidently the apparent disparity is due to a lack of effectiveness in the tropics of the classical prospecting techniques. In recent years new and sophisticated prospecting methods have been evolved in the more developed countries; their application and the research needed to make them fully effective in the tropical environment is the theme of this report. Four general categories of technique are considered: Geochemical, botanical (including biogeochemical), geophysical (induced polarization, gravimetry, magnetics, electromagnetics, seismic, resistivity, radiometric, etc.), and remote sensing from aircraft or spacecraft. The state-of-the-art, current research, instrument and survey, and research gaps and priorities are discussed for each method. An analysis is provided of the capability of developing countries to use the results of successful research and the likely economic payoff. A fairly extensive bibliography of selected references is included.

Safety

TRIGGERED LIGHTNING AND SOME UNSUSPECTED LIGHTNING HAZARDS

Stanford Research Institute. E. T. Pierce. January 1972. 25 pages.

AD–735 917

Lightning may be triggered by tall buildings, aircraft in flight, and other activities of man. This document considers the nature of the phenomenon with special reference to specific causative agents. The vulnerability to lightning of solid state devices and microcircuitry, computers, plastics, and electrically composite materials is discussed.

PROCEEDINGS OF THE CONFERENCE OF HAZARD EVALUATION AND RISK ANALYSIS

National Academy of Sciences—National Research Council, Advisory Committee on Hazardous Materials. August 1971. 163 pages.

AD-736 942

This document is comprised of the papers presented at a conference, held in Houston, Texas, 18–19 August 1971, which was concerned with an in-depth examination of systematic hazard analysis and risk evaluation. Emphasis was on the transportation and storage of hazardous materials. The topics covered include: Benefit-cost studies in socio-technical systems; applications of new technology to public safety; analytical approaches to risk evaluation; theory of decision risk analysis; problems in employing decision risk analysis; pyrotechnic hazard evaluation and risk concepts; environmental risk arising from the bulk storage of dangerous chemicals.

FIREPROOFING AND SAFETY SYMPOSIUM PROCEEDINGS

University of Southern California, Western Research Applications Center. May 1971. 154 pages.

N72-15894

These proceedings contain papers prepared for a symposium, held in Los Angeles, California, 27 May 1971, which was organized to help acquaint the business and industrial communities with new materials and techniques for improving fireproofing and fire safety. Many of the materials and techniques have been or are being developed and produced as a result of research sponsored by the National Aeronautics and Space Administration with the goal of minimizing fire hazards and reducing costs. Some of the topics covered are: Fireproofing and technology transfer; utilization of available skills and materials in fire prevention; new fire retardant foams and intumescents; some NASA-developed materials and industrial applications; fire retardancy using applied materials; fire retardancy with structural materials.

BASIS FOR THE DEVELOPMENT OF A SOIL STABILIZATION INDEX

Texas A and M University. Jon A. Epps, Wayne A. Dunlap, and Bob M. Gallaway. December 1971. 391 pages.

AD–735 295

Stabilizing soils to improve their engineering properties has been practices for centuries. However, chemical soil stabilization did not gain widespread acceptance in road and runway construction until after World War II. Even though a wealth of technical information and data now exists on soil stabilization, there has been no significant attempt to correlate this information into a useable system which would classify or index soils with respect to (a) their suitability for stabilization, and (b) the most appropriate type and amount of stabilizer to use. To further complicate matters the available data often favor a particular product, and do not include a worldwide variety of soils. A soil stabilization index system has now been developed to aid engineers in selecting the appropriate type and amount of soil stabilizer to use in pavement construction. This report contains the index system and the basis for its development. The index system is entered with easily determined soil properties and flow charts are followed to arrive at the most suitable stabilizer. Subsystems containing appropriate tests are used to determine specific amounts of stabilizers. Use factors, construction factors, and environmental factors are also considered in the decision-making process.

A PROCEDURE FOR DETERMINING ELASTIC MODULI OF IN SITU SOILS BY DYNAMIC TECHNIQUES

U.S. Army Engineer Waterways Experiment Station. A. A. Maxwell, and Z. B. Fry. October 1967. 23 pages.

AD–739 136

A procedure to determine the elastic moduli of *in situ* soils is described. The basic theory of wave propagation and relations of the elastic parameters are presented. The equipment and measuring techniques are described in detail. The procedure, in essence, employs the determination of the velocity of waves propagated at known frequencies along the exposed surface of the soil. The use of the information collected as an aid in the design and/or evaluation of foundations for structures is described.

CREEP OF COMPACTED CLAY

Purdue University, Joint Highway Research Project. S. V. Ramaswamy. July 1971. 224 pages.

PB–207 338

The report provides the results of research which was undertaken to establish a useful description of the time-dependent stress-strain behavior of compacted cohesive soils which could be incorporated in an analysis of boundary value problems in soil mechanics. The ultimate objective is to obtain a dependable means for predicting the long-term deformation of compacted clay embankments. The suitability of a generalized constitutive relationship for delineating the nonlinear time-dependent stress-strain behavior of compacted cohesive soil is examined. Stress dependent viscoelastic parameters obtained from triaxial creep tests are used to predict the time-dependent displacement of a plane strain strip footing, for which the stress field was different from the axisymmetric conditions existing in laboratory tests.

SOIL-CEMENT SLOPE PROTECTION ON BUREAU OF RECLAMATION FEATURES

Bureau of Reclamation, Engineering and Research Center. Glenn DeGroot. May 1971. 115 pages.

PB–207 418

In geographic areas where rock or stone riprap for slope protection is scarce, some other means must be found. One alternative is soil cement, formed by mixing portland cement with a natural soil in proportions optimal for the area. The document reports on compacted soil cement used as a riprap substitute at seven locations. Preconstruction testing, construction equipment, construction control testing, and performance of soil cement facings are discussed. A two part formation is described, in which portland cement is spread on the slope, mixed with the soil by a tractor-drawn mixer, compacted, watered, and scarified to receive a surface layer; this facing usually composed of fine silty or sandy soil mixed with portland cement, is mixed in determined proportions, placed and compacted. Durability tests of core samples are described, along with performance in the various locations.

Structural Engineering

FATIGUE FAILURE PREDICTIONS FOR COMPLICATED STRESS-STRAIN HISTORIES

University of Illinois, Department of Theoretical and Applied Mechanics. N. E. Dowling. January 1971. 87 pages.

AD–736 583

A cumulative damage procedure is described which permits the prediction of the fatigue failure of engineering metals subjected to complicated stress-strain histories. Histories with plastic strainings and cycles not completely reversed in stress are considered. Most previous workers in the area of cumulative damage have employed notched or bending members as test specimens. In such members the stresses and strains at the location of the fatigue failure are related to the applied loads in a complicated nonlinear manner and are usually unknown. The two variables most significant in determining fatigue life can therefore not be isolated for study. In the present method, the relationship between stress-strain behavior and fatigue life is investigated for unnotched axially loaded specimens for which the stresses and strains can be measured for the duration of all tests. Since either the stress history or the strain history is known before each test is conducted, the other can be estimated and a life prediction made.

BASIC CONCEPTS FOR DESIGN AGAINST STRUCTURAL FAILURE BY FATIGUE CRACK PROPAGATION

Naval Research Laboratory. Thomas W. Crooker. January 1972. 38 pages.

AD–736 618

Problems involving structural fatigue are outpacing fatigue prevention technology, despite a thriving activity in fatigue research. There are basically two reasons for this phenomenon: The application of higher strength materials; and a wave of rising expectations for the structural performance of these materials. The solution to this problem lies not only in continued fatigue research, but also in an understanding of the nature and severity of the structural fatigue problem by designers and an awareness of advanced design procedures to ward off crack-propagation failures. This document attempts to provide some basis for this understanding. The topics covered include: The structural fatigue problem; the traditional approach to fatigue; significance of crack propagation in structural fatigue; strain models for crack propagation; fracture mechanics models for crack propagation; factors involved in designing against crack propagation; initial flaw severity; crack-growth processes; ultimate flaw tolerance; synthesis into a unified design procedure; formulas for stress-intensity factors and fatigue life.

DESIGN OF TAPERED MEMBERS

State University of New York at Buffalo, Department of Civil Engineering. G. C. Lee, M. L. Morrell, and R. L. Ketter. December 1971. 129 pages.

AD–738 722

The use of tapered structural elements, having tapered depths and/or widths, was first proposed for reasons of economy in 1952. Tapered beam framing will result in weight saving for many structural and loading situations. The characteristic redistribution of stresses permits better utilization of structural material than does conventional, prismatic framing. This report covers all major aspects of the design of tapered frames. The primary objectives is to present the rationale behind the development of design formulas. Topics covered include: Frame and stress analysis; stability considerations; effective length; and development of design formulas.

COMPUTER ORIENTED ANALYSIS OF SHELL STRUCTURES

Lockheed Missiles and Space Company, and Air Force Flight Dynamics Laboratory. Richard F. Hartung (editor). June 1971. 1297 pages.

AD–740 547

This document represents the proceedings of a conference held at Palo Alto, California, August 1971. The primary objective of the conference was to bring together specialists in the field of computer analysis of shell and shell-like structures. The 27 invited papers are included in the document, as are transcriptions of the discussions held. The topics covered include finite element methods, finite difference methods, numerical methods, optimization, dynamic problems, and the stability of shell structures.

PROBABILISTIC MODEL FOR MATERIAL STRENGTH VARIATION AND SIZE EFFECT

Naval Civil Engineering Laboratory. Salah Nosseir, and Masanobu Shinozuka. February 1972. 36 pages.

AD–740 752

The stiffness and strength of most structural materials are subject to considerable variation, as shown by tests of samples taken from different areas of the same structural part. The differences are more conspicuous in composite materials such as structural concrete or fiber-reinforced composites. The random nature of resistance and the uncertainties involved in loading conditions have led to the use of specified minimum strength, the variation of which cannot be predicted for a given size of structural member. The report proposes a new interpretation for size effect, outlining the construction of a probabilistic model which is expected to provide an effective tool for dealing with structural failure analysis. A numerical example is given dealing with the simulation of the failure of concrete specimens and correlated with laboratory observations.

STRENGTH OF LONGITUDINALLY STIFFENED PLATE GIRDERS UNDER COMBINED LOADS

Lehigh University, Fritz Engineering Laboratory. Alexis Ostapenko, and Chingmiin Chern. December 1970. 50 pages.

PB–208 318

Deep plate girders, in order to be economical, require the use of longitudinal stiffeners. The function of the stiffeners is to enforce the web to develop higher buckling strength and to carry additional forces after the web subpanels buckle. A method is described for determining the static ultimate strength of these longitudinally stiffened plate girder panels subjected to a combination of shear and bending. The method is applicable to symmetrical, homogeneous, and hybrid girders. A comparison with available test data shows that this approach gives better and more consistant results than other proposed methods.

Testing and
Quality Control

CRITICAL THOUGHTS ON STRUCTURAL MECHANICS AND NDE

Franklin Institute Research Laboratories. Melvin B. Zisfein, and William B. Tarpley. September 1970. 36 pages.

AD–720 899

This report provides a critical review of the state-of-the-art of nondestructive evaluation (NDE) as it is actually practiced. Emphasis is on techniques employing radiography (x-ray and neutron), ultrasonics, penetrants, eddy currents, and thermography. Suggestions are given for possible ways of increasing user acceptance and utility.

BIBLIOGRAPHY OF INFRARED AND THERMAL TECHNIQUES FOR NONDESTRUCTIVE TESTING

Boeing Company, Vertol Division. March 1970. 155 pages.

AD–736 916

Within the field of nondestructive testing, probably no other technique has grown as rapidly as has infrared and thermal testing. This growth is reflected in the 364 abstracts of reports and papers which comprise this bibliography. The abstract are grouped according to the following general subject categories: Infrared techniques for electronic circuits and components; infrared for materials and structures; thermal (non-infrared) techniques; infrared test equipment.

ACCELERATED TESTING OF HIGH RELIABILITY PARTS. VOLUME I

General Electric Company. T Walsh, and G. Best. June 1967. 209 pages.

AD–819 853

ACCELERATED TESTING OF HIGH RELIABILITY PARTS. VOLUME II

General Electric Company. T. Walsh, and G. Best. June 1967. 131 pages.

AD–819 854

This report provides a basic theoretical approach to the definition of the parameters which should be measured during an accelerated test program for high reliability (electronic) parts. Data from long term tests are presented and analyzed to provide estimates of the life and life-governing processes for each of several types of part (resistors, capacitors, diodes, and transistors). The results of a physics of failure study of mica, ceramic, porcelain, and glass capacitors are also included. Volume I is the main portion of the report; Volume II contains data charts.

DEVELOPMENT OF A THERMAL NONDESTRUCTIVE INSPECTION SYSTEM TO DETECT CORROSION IN AIRCRAFT STRUCTURES

Automation Industries, Incorporated. R. E. Robichaud. October 1969. 28 pages.

AD–863 490

Corrosion which attacks metallic aircraft structures presents a serious maintenance problem and could, if unchecked, affect the structural integrity of an aircraft. This corrosion attacks the surface coating, the metal surface, and can attack the interior of the metal parts in the form of intergranular corrosion. Thermal methods of nondestructive inspection for corrosion have certain inherent advantages over the more common visual and ultrasonic methods. These include rapid inspection and noncritical positioning or alignment of the test device. This report describes a portable thermal nondestructive system for inspecting large structures in the field and laboratory. The system has the capability of detecting near surface material and structural defects such as voids, delaminations, unbonds, inclusions, and corrosion.

TESTING METHODS AND TECHNIQUES: STRENGTH OF MATERIALS AND COMPONENTS. A COMPILATION

National Aeronautics and Space Administration, Technology Utilization Office. 1971. 26 pages.

N72–18899

A number of testing methods and techniques developed by or for NASA have potential applications outside of the aerospace industry. The document presents brief summaries of methods, techniques, and devices used in testing the mechanical properties of various materials. Although metals and metal alloys are featured prominently, some of the items describe tests on a variety of other materials, from concrete to plastics. The test approaches presented can result in considerable cost savings and improved quality control. A form for requesting additional technical information is included.

THICKNESS MEASUREMENTS USING EDDY-CURRENT TECHNIQUES

Oak Ridge National Laboratory (AEC), Metals and Ceramics Division. C. V. Dodd, and W. A. Simpson, Jr. March 1972. 33 pages.

ORNL–TM–3712

In many critical industrial applications, the performance of a component depends on the thickness of a metal or on the thickness of one metal clad on another. Eddy currents have been used for many years to measure such thicknesses. Curves are presented in this report which allow a quick and accurate method of designing eddy-current tests and eddy-current coils. They also help apply existing coils more intelligently to inspection problems, allow rapid feasibility studies to be made, and show the effects of undesirable variables.

DESIGN CRITERIA FOR ACOUSTIC EMISSION EXPERIMENTATION

University of California, Lawrence Radiation Laboratory. C. A. Tatro. June 1971. 29 pages.

UCRL–73230

Acoustic emission technology in its present state is ready for application to a variety of problems facing materials engineers and scientists. Equipment necessary to support this work is available in either prepackaged or component selectable form. The purpose of this document is to orient those having a broad knowledge of materials but no direct experience with acoustic emission technology. The emphasis is on experimental design. The magnitudes and characteristics of the acoustic emission response are described. The compromises in signal detection and data acquisition methods follow from this description. Those aspects of experimental design which are most likely to be foreign to the new user of acoustic emission techniques are pointed out, as are ways to assure that a proper design has been achieved. Results of an experiment which reveals the unique power of acoustic emission technology to reveal subtle changes in material are given as an example.

Transportation

MECHANICS OF PNEUMATIC TIRES

National Bureau of Standards, Institute for Applied Technology. Samuel K. Clark (Editor). November 1971. 853 pages.

COM–72–50039

This book is intended as an aid to the practicing engineer or research worker who has need of information concerning the mechanics of pneumatic tires. It assesses the current state mechanics both theoretically and experimentally. The topics covered include: Rubber structure and properties; friction of rubber; tire cord structure and properties; recent developments with tire cords and cord-to-rubber bonding; properties of cord-rubber laminates; structure of the tire; tire stress and deformation; contact between tire and roadway; skid resistance and directional control; the tire as a vehicle component.

ASSESSING ALTERNATIVE TRANSPORTATION SYSTEMS

Rand Corporation. James R. Miller, III. April 1969. 173 pages.

PB–185 167

Assessing the worth of complex alternatives in a decision situation is generally regarded as difficult. However, this task constitutes but one phase in the still more difficult process of producing such alternatives and making a final decision among them. While assessment and final choice must depend on subjective evaluations, a systematic and quantitative method of assisting such judgments would prove quite helpful. This document presents such an aid to evaluating regional transportation alternatives which is explicit, logically consistant, and replicable. In addition, the results of an experiment designed to measure the impact of the procedure upon professional decision makers are reported.

MEASUREMENT AND EVALUATION OF TRANSPORTATION SYSTEM EFFECTIVENESS

Rand Corporation. F. S. Pardee, T. F. Kirkwood, K. L. Kraemer, et al. September 1969. 470 pages.

PB–185 711

In choosing among alternative transportation systems, decision-makers at both policy and engineering levels need the analytic capability: to understand the major objectives of the groups affected by a transportation system change; to measure system performance on each of a number of attributes or dimensions and assess the relative importance of the attributes; to analyze the implications of decisions across a full mix of transportation modes; and to predict the range of impacts of a system change upon cities, rural areas, and larger regions. This report describes a comprehensive and systematic methodology for evaluating the potential benefit of alternative transportation proposals. Attention is also given to the measurement of transportation effectiveness in a social context.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON URBAN TRANSPORTATION (5TH) HELD AT PITTSBURGH, PENNSYLVANIA, 8-10 SEPTEMBER 1971. MOBILITY–THE FIFTH FREEDOM

Pittsburgh Urban Transit Council; U.S. Department of Transportation; and Carnegie-Mellon University. September 1971. 224 pages.

PB–208 972

The proceedings are comprised of the presented papers, addresses, and discussions from the conference. The topics covered include urban transportation management, financing, and control; inner city-to-suburbs problems; reduction of congestion and air pollution obtainable by use of mass transit in place of automobiles; economic relief for railroads; design of a metro system; the importance of bus service; airport technology improvement; roadway design and automated expressways; ongoing programs in the United States and other nations, social and psychological benefits; investment inducements; vandalism and transit crime; and substitutes for fares as the principal source of revenue.

THAILAND TRANSPORTATION COORDINATION STUDY. VOLUME I

Wilbur Smith Associates and Lyon Associates, Incorporated; and Ministry of Communications, Royal Thai Government. G. L. Drake, and J. E. Traylor. June 1970. 536 pages.

PB–210 326

Thailand has a rapidly expanding economy and has had an even more rapid growth of its transportation resources. The report provides an assessment of the efficiency with which the present transport systems are employed, the factors underlying inefficiencies and possible corrective actions, the future course of the economy and consequent transportation requirements, the general direction of future investments, and selected implications of study recommendations. This first volume contains the basic description of the studies and findings.

THAILAND TRANSPORTATION COORDINATION STUDY. VOLUME II

Wilbur Smith Associates and Lyon Associates, Incorporated; and Ministry of Communications, Royal Thai Government. G. L. Drake, and J. E. Traylor. June 1970. 537 pages.

PB–210 327

This second volume of the Thailand Transportation Coordination Study is comprised of technical appendices for use with the first volume. Its contents include: A survey of the economy of Thailand; a forecast of economic growth to 1978; determination of highway capacity; truck weights; motor fuel consumption; transportation investment plan; current and projected highway travel; highway cost allocation analysis; highway user charges; highway-user tax payments; passenger fares for rail, inter-city bus, water, and domestic airline travel.

LAKE CHAD BASIN TRANSPORT SURVEY

Experience, Incorporated, and King and Gavaris, Consulting Engineers, Incorporated. October 1970. 611 pages.

PB–210 379

The need for good all-weather roads is evident in the Chad Basin Region of Central Africa, where four countries—Cameroon, Chad, Niger, and Nigeria—have regions which appear to offer potential for expanded agricultural development, but lack an adequate transport network. Such a network would help reduce the costs of agricultural inputs, production, and the transporting of commodities or processed agroindustrial end products. This study examines three proposed road links in the Chad Basin Administrative District. It includes a survey of the present economy of the region, including determination of its natural and human resources and the establishment of primary and secondary zones of influence along the road links. It also examines the existing transport network serving the region. An analysis is provided of present and projected activity for the region. The report also includes preliminary engineering data, time schedules, and costs; projected construction and maintenance costs; the economics of bridges versus existing ferry service at appropriate points; highway maintenance organization and programs; and the computation of benefit/cost calculations, internal rate of return, and costs in relationship to the varied rates of return for each country.

A TRANSPORT RECONNAISSANCE OF THE NORTHEAST CONGO REGION

Agency for International Development. Robert B. Keating, and John T. Howell. December 1970. 100 pages.

PB-210 420

Improved transportation has been recognized by the Zaire Republic (formerly the Democratic Republic of the Congo) as a key factor in the success or failure of its development efforts. This report is a result of a 8,000 kilometer transport reconnaissance of the Northeast Region of Zaire. Lying within an arc circumscribed by Bumba/Ikela/Kindu/Bukauv and the frontiers with Central African Republic, Sudan, Uganda, and Rwanda, the region is the most productive agricultural area in Zaire. The report first discusses national and regional transport planning requirements in general, and then treats the Northeast region in particular. A review of the economic basis of the region is followed by a description of ports, railroads, airports, road networks, traffic flows, the trucking industry, and the movement of goods. Present planning deficiencies are enumerated, and the need for an overall development plan is discussed. Details are given of a recommended emergency road reconstruction and maintenance program.

TRANSPORTATION TECHNOLOGY FOR DEVELOPMENT. VOLUME I

Battelle Memorial Institute, Columbus Laboratories. E. S. Cheaney, D. M. Landreman, and R. D. Leis (editors). February 1968. 378 pages.

PB-210 592

This report provides background information on the technology of various transportation modes and their capabilities. It is intended primarily for use by economists, program officers, general engineers, and others in the economic development field. Information is included on the broad capabilities of particular modes to handle freight and passenger traffic; major features and the advantages and limitations of each mode in terms of technical capabilities; levels of technological sophistication that can be adopted within each mode; and the 'inputs' of right-of-way preparation and construction, materials, vehicles, equipment, maintenance, and manpower required at each level to produce an 'output' of transport service. Volume One contains sections on: Intermodal factors of choice in transportation; highway transportation; railway transportation; conventional air transportation; V/STOL aircraft; inland waterway transportation; oceanway transportation; pipeline transportation; and intermodal freight exchange.

TRANSPORTATION TECHNOLOGY FOR DEVELOPMENT. VOLUME II

Battelle Memorial Institute, Columbus Laboratories. E. S. Cheaney, R. D. Leis, and D. M. Landreman (editors). February 1968. 231 pages.

PB–210 593

This second volume of the transportation technology for development study contains sections on: Aerial tramway transportation systems; beltway (endless moving belt) transportation systems; monorail transportation systems; air cushion (or ground effect, surface effect) vehicle transportation systems; hydrofoil transportation systems; special purpose vehicles (i.e., those capable of moving over terrain away from established route networks); new power sources and their effect on transportation technology; external technological factors (food production, water supply, mining and mineral processing, petroleum production, power generation) and their influence on transportation needs.

NATIONAL HIGHWAY PLAN

Consultora Latinoamericana, Ltda.; and Republic of Guatemala, Department of Highways. Raul Leclair, and James R. Snitzler. December 1968. 193 pages.

PB–210 622

The report concerns the development of a National Highway Plan for the Republic of Guatemala through 1974, and the formulation of criteria for a long-term plan through 1984. A detailed analysis is made of the national and departmental economies by major sectors and by product groups, including specific projections for the years 1974 and 1984, and general sectorial projections to 1994. An evaluation is then made of the country's transportation system including its effectiveness in meeting the nation's transport needs. User charges of highways are analyzed and comparisons are made with highway expenditures. Priorities of projects are indicated by the Internal Rate of Return computed for each project.

URBAN PLANNING IN DEVELOPING COUNTRIES

Department of Housing and Urban Development. Lloyd Rodwin. 1968. 68 pages.

PB–179 359

Natural population increases coupled with heavy in-migration from rural areas are outstripping the provision of urban facilities in most developing countries. These changes pose grave problems for the future. There is an urgent need for the orderly development of major population centers. This document describes the job of the city planner in developing countries. It does this by examining the case of the planning of Ciudad Guayana, a new city built in Venezuela. This endeavour is examined from the standpoint of planning technique and, in addition, consideration is given to the functions which such an urban planning enterprise may have in a developing country. While certain features of the case described are characteristic only of Venezuela, or of the problems of new cities, many of the problems confronted and techniques used are relevant to urban, regional, and national programs throughout the world.

VILLAGE HOUSING IN THE TROPICS, WITH SPECIAL REFERENCE TO WEST AFRICA

Department of Housing and Urban Development, Division of International Affairs. Keith H. Hinchcliff. June 1969. 72 pages.

PB–188 926

Agriculture is the foundation of wealth in West Africa. The concomitant of agriculture is villages. The creation of efficient villages where a high standard of life is possible is a prime town planning responsibility. This publication is intended as a guide to those responsible for locating and designing villages, and have not at their disposal the services of an architect or planning officer. The subjects covered include: Housing layouts; health and hygiene; neighborhood centers and special buildings; building materials; construction; design details; gardens, treeplanting; walls; village street furniture; and signs.

A GUIDE FOR REDUCING AIR POLLUTION THROUGH URBAN PLANNING

Alan M. Voorhees and Associates, Incorporated; and Ryckman, Edgerley, Tomlinson and Associates. Alan M. Voorhees, Salvatore J. Bellomo, Edward Edgerley, Jr., et al. December 1971. 112 pages.

PB–207 510

Urban planners, by nature of their responsibility for guiding urban growth and change, have a significant role to play in reducing air pollution and its effects. This guide is designed to help planners understand the relationship of air quality to land use patterns and transportation systems. Specifically, it has two purposes: to indicate the air pollution effects of various planning strategies, and to suggest how land use and transportation planning can be used directly to control air pollution. The topics covered include: Role of and legislative mandate for urban planning; reducing air pollution through land use and public facility planning; reducing air pollution through transportation planning, design, and operations. An appendix provides a general review of air pollution characteristics for the nonspecialist.

METHODS FOR ALLOCATING EMERGENCY UNITS

New York City Rand Institute. Jan M. Chaiken and Richard C. Larson. May 1971. 66 pages.

PB–208 549

The report is a survey of current research on the allocation of municipal emergency service systems, with emphasis on police patrol cars and firefighting vehicles. The survey grew out of the consideration that urban police, firefighting, emergency ambulance, and similar services comprise an important class of governmental agencies that only recently have benefited from systematic analysis of operational problems. The document describes the results that have produced or can produce substantial improvements in system performance. Aspects of allocation policy discussed include determining the number of vehicles to have available during the day or week, selecting the units to respond, defining the locations or patrol areas for units on duty, designing coverage patterns, and deciding when units should be redeployed to improve service in areas where a large number of units are temporarily busy.

RESEARCH METHODS FOR HOUSING AND URBANIZATION STUDIES IN DEVELOPING COUNTRIES

Cornell University, Center for Housing and Environmental Studies. Margaret E. Woods, and Earl W. Morris. June 1969. 479 pages.

PB–210 128

A pilot study of urban housing was undertaken in San Juan, Puerto Rico, to design and test methodological tools for the conduct of housing research in the urban areas of Latin America. Specifically, social, economic, demographic, and political aspects of urban housing were studied. This document is based on the findings of that study. The first portion provides a broad survey of methods of survey research and their applicability to the conduct of sample surveys in the urban areas of developing nations. Next, methodology and techniques are presented for measuring housing characteristics and quality, socioeconomic and demographic characteristics of families, attitudes, aspirations, and value orientations with respect to housing, and two means by which a housing situation may be improved: residential mobility and the improvement of owner-occupied housing. A discussion is given of the methodology and techniques by means of which two major components of the process of urbaniaztion—internal migration and social assimilation—and their relationship to urban housing may be explored. Overall, an attempt is made to present the theoretical background of the methodology, to cite findings from previous studies, and to relate the theory and empirical findings, insofar as possible, to urban housing situations in Latin America.

Water Supplies and Hydrology

CLEAN WATER: AFFLUENCE, INFLUENCE, EFFLUENTS. A DESIGN FOR WATER QUALITY MANAGEMENT

ASEE-NASA Langley Research Center, and Old Dominion University Research Foundation. Albert E. Millar, Jr., J. Darrell Gibson, and Richard D. Klafter (Editors). 1971. 240 pages.

N71-37861

This document is the result of a program in interdisciplinary systems design, sponsored jointly by the National Aeronautics and Space Administration and the American Society for Engineering Education, which was held at Old Dominion University, Virginia, during the summer of 1971. In essence, it provides a review of the current state of the water pollution problem, and it describes the magnitude and complexity of the remedies which have been formulated by governmental and private factions. A management system for water resources is proposed, and specific recommendations are made which are felt to be essential to achieve the goals of improved water quality. Also included is a case study of the James River, Virginia, and the recommendations made in the report are applied to this river basin.

GROUNDWATER LAW, MANAGEMENT AND ADMINISTRATION

National Water Commission. Charles E. Corker, and James W. Crosby. October 1971. 554 pages.

PB-205 527

The term "groundwater" serves to describe water beneath the surface of the earth or water that has been produced from an underground source. While underground it helps support the earth's surface, and it often supports the flow of surface streams. This report concerns the legal, managerial, and administrative aspects of this resource, particularly those which must be faced on a national scale. The first portion reviews the fundamentals of groundwater hydrology in layman's terms. A description is then given of the "doctrines" of groundwater law, and some goals and objectives of proper groundwater regulation are discussed. Some of the problems of groundwater law are examined and solutions are proposed. The management of a groundwater resource is considered, with emphasis on alternative directions to the solution of the management problems, the powers necessary for effective management, and the limitations on groundwater management. Finally, a special section concerns itself with the economics of groundwater use.

THE ALLOCATION OF WATER RESOURCES PROJECTS METHODOLOGY: A MODEL FOR THE ALLOCATION OF FUNDS FOR THE DEVELOPMENT OF WATER RESOURCES

University of Oklahoma, Bureau of Water Resources Research.
1971. 137 pages.

PB–205 803

An analysis and evaluation is made of present methods used in the allocation of funds for all levels of water resource development and a new, different and more suitable allocation methodology is formulated. Particular emphasis is placed on incorporating a goal-oriented model to provide predictions of future water resource demands and on utilizing systems analysis techniques for determining the allocation of funds for development of water resources. The goal is full resource development. If one can state one's future goals quantitatively, the model can formulate an efficient program of water resource development which will enable one to meet the water resource needs necessary to achieve those goals.

OPERATING GUIDELINES FOR MULTIPLE-PURPOSE RESERVOIRS

University of Missouri, Missouri Water Resources Center. Allen
T. Hjelmfelt, Jr. July 1971. 35 pages.

PB–205 806

A multipurpose reservoir is designed to store water for several purposes and to provide reserve capacity for storage of possible floods. Current practice results in operating guidelines determined by a moderate amount of analysis and a great deal of engineering judgment. The random nature of the flows into the reservoir and the economic effect of the decisions made are inadequately considered. This report presents a method of evaluating guidelines for the operation of a multi-purpose reservoir. The method will provide a tool useful for future planning, for evaluation of current practice with in-service reservoirs, and modifying guideline to satisfy changing demands on a reservoir.

MODELING OF HYDROLOGIC PROCESSES AND WATER SALVAGE PROCEDURES IN SEMIARID REGIONS

University of Arizona. M. M. Fogel, J. L. Thames, and L. Duckstein. December 1971. 41 pages.

PB–206 121

Effective management of water resources is dependent on rainfall-runoff-quality relationships and on a set of inputs adequately represented in the time-space domain. An important input in many hydrologic systems is the short-duration, high-intensity localized thunderstorm rainfall that produces most of the floods in urban and small rural watersheds. A methodology is set forth in this report to model and analyze rainfall and runoff events utilizing the basic concepts of probability theory applied to the general modeling problem. The method may be used to produce a synthetic rainfall set which, in turn, is useful for determining annual water yield, for evaluating runoff modification due to vegetative manipulation and urbanization, and for determining the effectiveness of water conservation practices such as artificial recharge and water harvesting.

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COMPUTER AND PHYSICAL MODELS FOR SOLVING SUBSURFACE PROBLEMS IN HYDROLOGY

University of Wisconsin, Water Resources Center. Gabor M. Karadi, and Gilbert L. Roderick. 1971. 68 pages.

PB–206 141

The evaluation of groundwater systems is usually accomplished by use of theoretical solutions to unsteady seepage flow, and virtually all existing solutions to such problems are based on some type of approximate formulation associated with idealized conditions. Although a number of experimental investigations have been directed toward determining the limits of applicability of these different approximations, relatively little work has been done to establish appropriate theoretical criteria. This report discusses and evaluates the different methods employed to solve transient groundwater flow problems associated with the two-dimensional drainage of a phreatic aquifier in a homogeneous, isotropic soil. New solutions are proposed which are believed to be more advanced than existing ones in describing groundwater flow under these conditions. Experiments carried out to evaluate the accuracy of the solutions are described.

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A NEW TYPE OF DISINFECTANT FOR WATER SUPPLIES

Kansas Water Resources Research Institute. J. L. Lambert, and L. R. Fina. June 1971. 20 pages.

PB–205 823

A water disinfecting process that releases antibacterial and antiviral chemicals upon demand, leaving virtually no detectable disinfectant in the water, has been developed. The disinfectant is prepared by saturating strongly basic anion exchange resins with triiodide. Water to be treated is simply passed through a column of the resin-triiodide complex. The kill of virus and bacteria is immediate and irreversible.

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REGIONAL ECONOMIC DEVELOPMENT–THE ROLE OF WATER

Utah State University Foundation, Economics Department. W. C. Lewis, J. C. Anderson, H. H. Fullerton, and B. D. Gardner. October 1971. 356 pages.

PB–206 372

This document is designed to provide a conceptual basis for analyzing the effectiveness of water resource investment as a means of inducing economic development in subnational regions. It deals with: Analysis of the economic rationale for using water resources development to achieve regional economic development; analysis of water resources development as a means of inducing regional economic development; evaluation of approaches for predicting regional development effects of specific types of water resources development. The approach used involves the definition of a region, the consideration of theories of growth and development, and the examination of the following: Measures of economic growth and development, welfare and well-being, water in the production process, general sequences of development impacts, regional and water investment types, some empirical techniques for the evaluation process, and the relationship of techniques of analysis to a cost benefit framework and to proposed multiple objective planning procedures.

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FORECASTING WATER DEMANDS

National Water Commission. R. G. Thompson, M. L. Hyatt, J. W. McFarland, and H. P. Young. November 1971. 356 pages.

PB–206 491

An analysis is provided in this document of the effects of different policy alternatives, of technical developments, and of rates of population and economic growth on future supplies of and demands for water. The first section presents a basis for common understanding of a number of concepts and terms related to forecasting demands for water and water-related products and services. Previous national forecasting studies are then evaluated; and the principal variables affecting water supplies are described and their interactions are discussed. Measures of demands in selected water-using activities are developed, and the effects on water use of variations in major policies and technology are illustrated. Data variations are developed for an important existing water use forecasting model, and these data variations are combined with results of models described in the report to illustrate alternative future demands for water.

MERCURY IN WATER. A BIBLIOGRAPHY

U.S. Department of the Interior, Water Resources Scientific Information Center. January 1972. 298 pages.

PB–206 535

This document is comprised of abstracts of 195 selected articles and reports concerning the occurrence of mercury in water and problems associated with such occurrences. The literature covered includes that published since 1967. A comprehensive index is included. Brief descriptions are given of a number of research projects in progress.

TECHNIQUES FOR ASSESSING WATER RESOURCE POTENTIALS IN THE DEVELOPING COUNTRIES, WITH EMPHASIS ON STREAMFLOW, EROSION AND SEDIMENT TRANSPORT, WATER MOVEMENT IN UNSATURATED SOILS, GROUND WATER, AND REMOTE SENSING IN HYDROLOGIC APPLICATIONS

U.S. Geological Survey. George C. Taylor, Jr. December 1971. 72 pages.

PB–207 192

To use and control water effectively requires knowledge of its behavior in the environment and this knowledge is acquired through collection, analysis and interpretation of hydrologic data. This report is intended to help planners in the developing countries assess water resource potentials through hydrologic techniques. It presents a review of the state-of-the-art, instrument and investigation costs, and current research related to streamflow, erosion, sediment transport, water movement in unsaturated soils, and ground water. Consideration is also given to remote sensing in hydrologic applications, and research gaps and priorities. Emphasis throughout is on tropical regions, in which most of the developing countries lie.

BENEFITS OF WATER QUALITY ENHANCEMENT

Syracuse University, Department of Civil Engineering. Nelson E. Nemerow. December 1970. 194 pages.

PB–207 358

Water pollution is becoming an increasingly urgent problem, particularly in densely populated areas. This report describes the development of a common quality expression for relative states of pollution of a watercourse. It is concerned with the implementation of pollution abatement at a local level of government. The report is in three parts. The first contains a discussion of the past practices and recent trends in water pollution control as it relates to water quality. Next the dollar benefit of a lake or stream at a given water quality is determined by listing all uses which both affect and are affected by water quality, by valuing each use individually, and by summing the resultant values. Finally, a study is reported of a methodology for water pollution abatement administration at the local or regional level, using Onondaga Lake, New York as an example.

AGRICULTURAL RUNOFF. A BIBLIOGRAPHY

Office of Water Resources Research, Water Resources Scientific Information Center. January 1972. 252 pages.

PB–207 514

A bibliography is presented of materials, published mostly since 1967, on surface water runoff as applied to agriculture. It includes 158 abstracts of selected reports, journal articles, and other documents produced from a computerized information base on water resources. Among the topics covered are agricultural watersheds, aquatic plant data, arid lands, digital computer technology, drainage, eutrophication, fertilizers, ground waste flow, irrigation, mathematical modeling, nitrogen cycle, organic matter influence, environmental factors, information retrieval, salinity, soil characteristics, water pollution sources including pesticides and phosphates, waste water, farm wastes, and water reuse. An index is included.

DYNAMIC SIMULATION OF UNSTEADY FLOW OF WATER IN UNSATURATED SOILS AND ITS APPLICATION TO SUBIRRIGATION SYSTEM DESIGN

Texas A and M University, Water Resources Institute. E. A. Hiler, and S. I. Bhuiyan. November 1971. 108 pages.

PB–207 642

A recently developed concept in irrigation is the subsurface irrigation system, designated subirrigation, by which irrigation water is applied beneath the soil surface by means of multiorificed or porous plastic pipes. The system is attracting interest since it supplies water to the roots of plants where it is actually consumed, and it reduces water loss by evaporation since there is no surface wetting. The theoretical basis of such a system is flow of water in unsaturated soils. A mathematical model capable of predicting the movement of water in unsaturated soils is essential for development of a subirrigation system design. A report is made on a digital simulation of the process. Two computer programs were developed. One concerns vertical unsteady infiltration through the surface into a clay and two loams. The other deals with vertical flow in an unsaturated homogeneous soil during infiltration from a buried source, followed by drying. Criteria for a subirrigation system design are characterized, and an approach utilizing the model for determining the optimum depth of the subirrigation source was developed.

A MODEL OF COMMUNITY PROBLEM SOLVING; AND SELECTED EMPIRICAL APPLICATIONS

Ohio State University, Water Resources Center. Russell R. Dynes, and Dennis E. Wenger. December 1971. 161 pages.

PB–208 596

The report concerns methodologies of coping with water resource problems, dealing with one methodology which is deemed general: a community problem solving process which cuts across the variety of community problems but is designed to understand the water related ones. A model of community decision making is outlined which can apply to a number of communities, centered on exercise of social power. It considers the power structure of a community and its leadership, termed the leadership pool, in relation to the types of community action that are proposed. Behavior patterns are noted. The model provides a guide for varied empirical application, three of which are presented. The variables are described for six different communities of different population size. In two of the communities types of community action are analyzed. The findings relating to perception of water problems in four smaller communities are compared to similar findings in the two larger communities.

CLASSIFYING WATER BODIES: FEASIBILITY AND RECOMMENDATIONS FOR CLASSIFYING WATER

Colorado State University, Department of Recreational Resources. Robert Aukerman, and George I. Chesley. December 1971. 123 pages.

PB–208 667

Increasing population leads to increasing demands for water, often conflicting, thereby making imperative an organized system for handling water allocations. Consideration should be given to fish and wildlife, recreation, and industrial uses. The report examines these and allied considerations in determination of the feasibility of classifying water bodies and segments thereof by potential use, and the desirability of designating certain waters for specific uses. It identifies criteria for a useful water classification system and evaluates existing natural resource classification systems. Weaknesses of predetermined categories and limited purpose classifications are discussed. Appendices to the report contain factors critical to specific water uses, related literature, and methodology.

RECYCLING AND ECOSYSTEM RESPONSE

Michigan State University, Institute of Water Research. Harry K. Stevens, Thomas G. Bahr, and Richard A. Cole. February 1972. 135 pages.

PB–208 669

It may be stated that water management is inseparable from environmental management in its broadest context. This report shows that many of the solutions to current water problems can be solved only through proper management of other natural resources. The first part discusses the attributes of ecosystems in general, and provides a summary of the differentiation of the physical subsystems which result from the differential reception of energy. Consideration is then given to the natural cycling of materials and the role played by the biotic communities, with emphasis on the resistance and vulnerability of biotic communities to the stresses imposed by the physical and chemical environment. The ecosystem is discussed theoretically and translated into a more practical management unit, the watershed. The interactions of terrestrial and aquatic subsystems under disturbed and undisturbed conditions are briefly summarized. Man's role in the function of ecosystems is discussed from the point of view of the sensitivity of ecosystems to human manipulation. The point of the foregoing sections of the report is to establish inseparable ties between water and other portions of watershed ecosystems in enough detail to develop a rationale for the recommendations which form the final section of the report.

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WATER QUALITY CRITERIA DATA BOOK. VOLUME 1. ORGANIC CHEMICAL POLLUTION OF FRESHWATER

Arthur D. Little, Incorporated. December 1970. 399 pages.

PB–208 987

WATER QUALITY CRITERIA DATA BOOK. VOLUME 2. INORGANIC CHEMICAL POLLUTION OF FRESHWATER

Arthur D. Little, Incorporated. July 1971. 280 pages.

PB–208 988

These volumes provide the results of comprehensive surveys of the literature which were conducted to obtain data relevant to the establishment of water quality criteria. Over 490 organic chemicals and over 260 inorganic chemicals were found to be potential pollutants, although only 66 of the former and 87 of the latter have actually been identified in fresh water. For the most part, these volumes are comprised of an extensive series of tables relating to these compounds. The data contained therein include: Concentration of pollutants in fresh water; mammalian toxicity, carcinogenicity, and mutagenicity of the various chemicals; sources of pollutants; and permissible concentrations in fresh water. Indexes and rather extensive bibliographies are also included.

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PRICING AND EFFICIENCY IN WATER RESOURCE MANAGEMENT

George Washington University, Natural Resource Policy Center. Robert K. Davis, and Steve H. Hanke. December 1971. 283 pages.

PB–209 083

Any increase in the consumption of most commodities is a benefit to the consumer. But every expansion in output implies withdrawal of resources from the production of some other item. The general function of prices is to assert proper checks and balances on production and consumption in an economy. In this role prices have two functions: to discourage excessive consumption of a commodity and to induce the desired supply of that commodity. Prices can play this role not only in the marketing of private goods, but also in regulating the production and consumption of certain commodities produced by governments. A review is presented in this document of problem areas and water resource services where prices can be easily applied and/or where there are substantial gains to be realized from a policy of user or beneficiary charges in the areas of navigation, flood control, municipal water and industrial use of municipal sewers. It is believed that these areas hold substantial promise for improved pricing policies. The remaining statements are made in regard to the more imposing problems; e.g., of outdoor recreation, fish and wildlife habitat, hydroelectric power, and irrigation. A water rate simulation of a large municipal water-sewer utility is provided in an appendix.

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SURFACE-WATER RESOURCES OF THE YOBE RIVER SYSTEM NORTHERN NIGERIA, 1963-68

U.S. Geological Survey. B. E. Colson. January 1969. 213 pages.

PB–210 594

The Yobe River system, which is tributary to Lake Chad, drains an area of about 33,000 square miles in a semi-arid region of northern Nigeria. This report describes the general hydrologic features of the Yobe drainage basin and presents hydrologic data on gage heights, daily discharge, and analysis of chemical quality and sediment content of water samples for 18 stations is the system.

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REPORT OF THE JOINT U.S.A./GHANA COMMITTEE ON AGRICULTURAL EXTENSION AND RESEARCH

U.S. National Academy of Sciences, and Universities of Ghana, Council for Scientific and Industrial Research. October 1971. 55 pages.

PB–208 605

Ghana is a nation undergoing severe pressures for rapid adjustments to achieve increased production for internal requirements and world trade. In agriculture, institutions for research, teaching and extension have been built. Constant advances in technology at the farm level are being made. However, it is recognized that the mechanisms which have been built in government for the translation of results of agricultural research to the benefit of the Ghanaian farmer are inadequate. The Joint Committee on Agricultural Extension and Research has endeavoured to recommend a program of agricultural services. If followed on a long-term basis, this will evolve a system of extension which will increase agricultural productivity and enhance the well-being of the farmers. This document presents the keynote addresses, by Mr. M. Dowuona, Dr. K. Safo-Adu, and Dr. D. W. Barton, which were given at the inaugural meeting of the Committee, 27 September 1971, at Accra; and section on essentials for an extension program in Ghana, the present position of agricultural extension in Ghana, recommendations for an effective extension program, and possible external support.

CARE AND MAINTENANCE OF FARM MACHINERY. A HANDBOOK FOR FARM OPERATIONS IN TROPICAL AGRICULTURAL AREAS

Michigan State University. Norwin Braun. June 1968. 49 pages.

PB–210 130

A functional farm workshop is a most valuable asset to any university farm. It is even more important in developing countries that are remote from ready access to machinery replacements, spare parts, and company field men. In order to keep machinery in the best working condition, a thorough preventive maintenance program must be developed and closely adhered to. This handbook is intended as a guide for such a program. The first portion concerns itself with farm machinery safety; this is followed by a discussion of the structure and role of the mechanic section of a farm operations department. The main portion of the handbook provides guidelines for the care and maintenance of tractors, small engines, bulldozers, and other farm implements such as plows, planters, forage harvesters, forage wagons, and mowers. This publication was written for the Farm Operations Department at the University of Nigeria, Nsukka, but it is equally applicable to any farm operation in a developing nation.

TECHNOLOGICAL CHANGE IN AGRICULTURE. EFFECTS AND IMPLICATIONS FOR THE DEVELOPING NATIONS

U.S. Department of Agriculture. Foreign Agricultural Service. Dana G. Dalrymple. April 1969. 88 pages.

PB-210 596

The effects of technological changes in agriculture in the less developed countries are a matter of increasing concern. As efforts to expand agricultural production begin to pay off, the many and complex ramifications of technological change become more and more evident. This document provides an introduction to some of the major effects of technological change in agriculture. Included among the topics considered are: The nature of technological change; adoption process for agricultural technology; impact of changes in agricultural technology; high-yielding varieties of grain; mechanization of agriculture; and policy implications of technological change. The document is basically intended as a reference for those engaged in development planning and development programs, and as background material for development scholars.

AN ANALYSIS OF THE POTENTIALS AND PROSPECTS OF INCREASING EDIBLE OIL PRODUCTS IN WEST PAKISTAN

U.S. Department of Agriculture, Foreign Economic Development Service. F. A. Coffey, D. M. Yermanos, J. R. Wilcox, et al. September 1971. 178 pages.

PB-210 597

This report represents one phase of a study on the potential for increasing oilseed production in West Pakistan. It provides a review of research, production potential, and problems of oilseed production and processing in Pakistan, the United States, and other countries where relevant. It includes a general economic analysis as well as detailed discussions on the production of safflower, sesame, peanuts, soybeans, sunflowers, and cottonseed.

Fisheries and
Aquaculture

REPORT OF FISHCULTURAL INVESTIGATIONS IN SOUTH VIETNAM

Auburn University. H. S. Swingle, and D. D. Moss. August 1969. 20 pages.

PB-195 903

REPORT OF FISHCULTURAL INVESTIGATIONS IN INDIA

Auburn University. H. S. Swingle, and D. D. Moss. August 1969. 27 pages.

PB–195 906

REPORT OF FISHCULTURAL INVESTIGATIONS IN THE PHILIPPINES

Auburn University. H. S. Swingle, and D. D. Moss. August 1969. 62 pages.

PB–195 909

These documents report the results of a series of surveys conducted in India, the Philippines, and South Vietnam on the status and prospects of fishculture activities in these countries. Particular attention is given to existing and proposed rearing and research stations. Recommendations are given concerning possible measures to assist the development of the fishculture industry in each country.

REPORT OF FISHCULTURAL INVESTIGATIONS IN THAILAND

Auburn University. H. S. Swingle, and D. D. Moss. August 1969. 38 pages.

PB–195 905

THE MARINE AND COASTAL FISHERIES STATIONS OF THAILAND

Auburn University. H. S. Swingle, and D. D. Moss. July 1969. 42 pages.

PB–195 911

THE INLAND FISHERIES PROGRAM OF THAILAND

Auburn University. H. S. Swingle, G. B. Pardue, R. O. Smitherman, D. D. Moss, H. R. Schmitton, and W. A. Rogers. January 1970. 165 pages.

PB–195 914

This series of documents reports the results of a survey of the status and prospects of the fishculture and fisheries industries in Thailand. Particular attention is given to the facilities and programs of existing fisheries stations. Recommendations are given for possible measures which may enhance the development and expansion of fisheries and fishculture activities in Thailand.

FORMULATION AND FABRICATION OF FOOD BARS

Pillsbury Company. Jack R. Darst. February 1966. 55 pages.

AD–631 996

The manufacture of food bars represents a food processing alternative which results in a product that combines a high degree of storage stability with a means of achieving a high degree of control of nutrient and physical characteristics. This document describes the formulation and production of food bars made from various cereal products, as well as beef, hash, and soup type bars. The basic matrix for the food bars is a stable binder formulated from protein (sodium caseinate), fat (lard flakes), and carbohydrate (sucrose). The binder is spray-dried, admixed with the food component, and compressed into bar form. The bar may be consumed in its manufactured form or rehydrated to a product simulating the conventional item.

RADIATION PASTEURIZATION OF FRUITS AND VEGETABLES. A BIBLIOGRAPHY

Oak Ridge National Laboratory (AEC), Isotopes Information Center. F. E. McKinney. January 1972. 90 pages.

ORNL–IIC–11 (Rev.)

This bibliography is comprised of 1264 references to the worldwide literature on the use of high-energy radiation to preserve fruits and vegetables. Author and subject indexes are included.

Industrial and General Economic Development

THE ROLE OF THE AGENCY FOR INTERNATIONAL DEVELOPMENT IN THE FIELD OF NATURAL RESOURCES PLANNING AND MANAGEMENT

Agency for International Development, Office of Science and Technology. April 1972. 153 pages.

PB–210 105

This report is one of the results of a Workshop on Natural Resource Planning and Management which was held on 21 January 1972 at Washington, D.C. It describes the key issues, significant observations, and major findings and conclusions which emerged from that session, as well as from documentation presented by U.S. technical agencies and multilateral institutions both in advance of and subsequent to the workshop. Some of the subjects covered include: Significance of natural resources to economic growth; constraints on natural resources development; current role of governments, development assistance agencies, and private industry; special capabilities of the United States for international assistance; activities and perspectives of U.S. technical agencies and international development institutions.

THE CERAMICS INDUSTRY IN THAILAND 1970

Roy E. Jordan, Jr., Ceramics Consultant. October 1970. 72 pages.

PB–210 138

The ceramic industry of Thailand is just beginning to emerge as an economic force in the kingdom. The rapid growth of the ceramic market in Thailand has led to marked expansion in domestic production and has attracted large joint venture investments in manufacturing facilities for ceramic products formerly imported. This report reviews available data and information on Thailand's ceramic industry and trade. Included is information on existing ceramic enterprises as well as approved or planned industrial projects. Sources, relative prices, and the volume of imports are discussed as well as other aspects of the growth potential in the ceramic sector. Data are also included on raw materials and their locations in the kingdom. A preliminary identification is made of investment opportunities.

DEVELOPMENT AND CHANGE IN A BENGAL VILLAGE

National Institute of Community Development (India); and Department of Communication, Michigan State University. Ajit Kumar Danda, and Dipali Gosh Danda. May 1968. 272 pages.

PB–210 332

The report presents a study of the process of planned change in a village of West Bengal, India. It describes in general terms the positive and negative reactions of farmers toward specific agricultural programs. The special emphasis is on the determination of the causes of rejection of an improved agricultural practice. The communication process of conveying modern ideas and practices to the villagers was also examined. The report describes the physical setting of the village, community structure, development and change, and adoption of innovations.

SCIENCE AND BRAZILIAN DEVELOPMENT. REPORT OF THE FOURTH WORKSHOP ON CONTRIBUTIONS OF SCIENCE AND TECHNOLOGY TO DEVELOPMENT

U.S. National Academy of Sciences, and National Research Council of Brazil. November 1971. 92 pages.

PB–210 345

The fourth in a continuing series of Brazil-U.S. workshop meetings, which are convened to bring together representatives from the scientific community, government, and private institutions to discuss informally problems relating to science and economic development, was held in Washington, D.C., 1–5 November 1971. The specific objectives of this meeting were: To review

Joint Study Group Activities in agricultural research, agricultural economics, computer science, geosciences, and industrial research; to review the operations of the Chemistry Program and discuss program strategy for the period 1972–74; and to review and evaluate the bilateral relationship of the U.S. National Academy of Sciences and the Conselho Nacional de Pesquisas (National Research Council of Brazil) and discuss future directions for joint activities. This document summarizes the activities and recommendations of the meeting, and reprints some of the background papers prepared for the meeting.

* * *

COMMUNICATION IN INDIA. EXPERIMENTS IN INTRODUCING CHANGE

National Institute of Community Development (India), and Michigan State University, Department of Communication. Joseph E. Kivlin, Prodipto Roy, Frederick C. Fliegel, and Lalit E. Sen. May 1968. 64 pages.

PB–210 508

An often encountered difficulty experienced by development programs involves gaining acceptance of beneficial changes by the populace. This document reports the results of a communication experiment which attempted to induce adoption of modern agricultural, health, and family planning practices by the inhabitants of a number of villages near Lucknow, Uttar Pradesh, India. The study sought to evaluate the continuing effects of two communication treatments; radio farm forums, and literacy training classes. The results indicate that while knowledge of the practices spreads rather quickly, adoption is slow and at low levels. Some progress was made, however, and clear cut differences in the effectiveness of the communication treatments were exhibited.

* * *

CENTO CONFERENCE ON FORESTRY DEVELOPMENT POLICY HELD IN ANKARA, TURKEY, JUNE 8-12, 1970

Office of the United States Economic Coordinator for CENTO Affairs. Mary Margaret Lawrence (editor). October 1971. 134 pages.

PB–210 511

The document is comprised of papers presented at a conference which had among its objectives the review and appraisal of forest development policies in the CENTO regional countries, with special emphasis on the relationship of these policies to the economic and social development of the region. The subjects covered include: Status of forestry and related fields in Iran, Pakistan, and Turkey; forest management trends; economic aspects and marketing in forestry and forest industries; range management problems; role of national parks and forest recreation in today's world; preserving a national heritage in Iran; national park development in Turkey; research in forestry and related fields; forestry education and public relations.

ECONOMIC COMPARISON OF OVERSEAS MANUFACTURE AND IMPORTATION OF ANHYDROUS AMMONIA

National Fertilizer Development Center. G. C. Patterson, J. R. Douglas, and J. K. Metcalfe. March 1969. 31 pages.

PB–210 595

Ammonia is the principal form in which fixed nitrogen is utilized in the manufacture of fertilizer materials. The production of ammonia by reacting hydrogen with atmospheric nitrogen is the basis of the modern nitrogen fertilizer industry. This report compares the economics in developing countries of importing ammonia from suppliers having large plants and low-cost feedstocks with those of producing the material under local conditions. Three countries, India, South Vietnam, and Uruguay, are used as a basis of the comparison. Since these countries have widely divergent needs for fertilizer materials, the costs applicable to them should be representative of many other developing countries with similar needs and resources.

PROBLEMS OF TRANSPORT AND COMMUNICATIONS IN THE ANDEAN GROUP

Harvard University, Center for International Affairs. David Morawetz. February 1972. 62 pages.

PB–210 598

The member nations of the Andean Group customs union, Bolivia, Chile, Colombia, Ecuador, and Peru, stretch the full length of the South American continent and cover almost one fourth of its area. The paper examines the problems of transport and communications within this group of nations. It is demonstrated that high transport costs and poor communications are likely to limit the expansion of intra-Andean trade. Comparative data are presented for the European Economic Community, and some suggestions are made for reducing Andean transport costs. Also included is an examination of comparative freight rates for intra-Andean trade and for Andean trade with the U.S. and Europe.

Technology Transfer and Utilization

A SURVEY AND CRITIQUE OF TECHNOLOGICAL FORECASTING METHODS

United States Naval Postgraduate School. James W. Rooney. September 1971. 94 pages.

AD–736 541

In developing information about the state of future technology, it becomes necessary to forecast what will or at least what could be available, based on information about the state of current technology. Thus, a review was made of the literature on technological forecasting in an effort to elucidate the techniques available for providing information about the future state of technology. It is the purpose of this report to examine, in the form of a critical survey, these technological forecasting techniques and in so doing give an account of the state-of-the-art of technological forecasting. In addition, some pitfalls of technological forecasting are discussed, and factors which should be considered in selecting a forecasting technique are suggested.

PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER (PATT)

University of Denver, Denver Research Institute. 1970. 55 pages.

N71–38779

One process by which a developing country can increase its economic and social level is technology transfer. Technology transfer is the process through which technical capability generated in the public sector of a socio-economic system becomes widely adopted in the private sector of that system. This report describes research on the Project for the Analysis of Technology Transfer (PATT). Technology transfer profile presentations were developed to achieve a better understanding of NASA-related technology transfer activities. A preliminary conceptual model of the technology transfer process was formulated. Also, an operational plan for strengthening the NASA Tech Brief Program was developed.

THE CONTEXTUAL APPROACH TO TECHNOLOGY ASSESSMENT. IMPLICATIONS FOR "ONE-FACTOR FIX" SOLUTIONS TO COMPLEX SOCIAL PROBLEMS

George Washington University, Program of Policy Studies in Science and Technology. Louis H. Mayo. April 1971. 92 pages.

N71–38781

Technology assessment may be defined as the identification of the effects or changes which result from the introduction of a technological application into the environment and the evaluation of the social impacts of such changes, i.e., the social desirability or undesirability of such effects. The report attempts to demonstrate that technology assessment can assist in identifying the means which will lead to more satisfactory alternative distributions of social benefits and social costs associated with public programs and projects having major technological components. Technology assessment as it relates to national policy is discussed. Methods of analyzing and projecting the prospective implications of technology assessment are explored. It is pointed out that even where one primary means (technological fix) is proposed for dealing with a special problem, the contextual (total social impact) approach to assessment of such means will disclose the arrangements required to effectively implement such means.

THE APPLICATION OF SCIENCE AND TECHNOLOGY TO PUBLIC PROGRAMS

Pennsylvania State University. Irwin Feller. August 1971. 533 pages.

PB–205 160

The document consists of papers, recommendations, and discussion of the Eastern Regional Conference on the Application of Science and Technology for Public Programs, held in Cambridge, Massachusetts on April 2–3, 1970. The conference focused on the complex of problems associated with rapidly expanding urbanization and consequent rural dislocation, such as providing adequate housing and transportation facilities, controlling pollution, organizing and delivering health services, providing fire and police protection, education and training. The major emphasis was on defining these problems confronted by state and local governments in terms of the potential contribution that science and technology could make to their solutions. Papers from workshop sessions are presented on the following topics: Air and water pollution; program planning and management; solid waste disposal; transportation; housing; crime control; health services; education; innovation; opportunities for state science action; system research and management for state and local systems; organizational fragmentation; mechanisms for resource allocation and program evaluation; new structures for Federal, state, and local government cooperation; universities and public service; resources for state manpower and financing; industry and government; new communities; saving old towns; regional cooperation in the use of computers; citizen feedback systems; and technology transfer.

SCIENCE AND TECHNOLOGY FOR INTERNATIONAL DEVELOPMENT: A SELECTED LIST OF INFORMATION SOURCES IN THE UNITED STATES

Agency for International Development, Office of Science and Technology. March 1972. 56 pages.

PB–210 104

The report presents a list of libraries and other organizations which have relatively complete and comprehensive holdings of publications pertaining to science and technology in developing countries. For each of these organizations, information is provided concerning the nature and strength of the collection, publications issue, information services provided, and the individual to contact for further assistance. A listing of reports produced by, for, or with the assistance of AID and which are available from NTIS is given. Also included is a list of reports on science and technology for international development issued by various other international and regional organizations.

SCIENTIFIC AND TECHNICAL INFORMATION FOR DEVELOPING COUNTRIES

National Academy of Sciences, Board on Science and Technology for International Development. April 1972. 92 pages.

PB–210 107

Scientific and technical information is an essential element in the economic development process. A rationale is needed to guide the formulation of assistance programs addressed to the problem of information resources in less developed countries. This report is intended as a first step toward meeting this need .The first portion elaborates the need for more effective use of scientific and technical information in development efforts, and then outlines a rationale for increased technical assistance in this area. A review is provided of the functions of the information transfer process and the necessary components of the information infrastructure. Consideration is given to specific information requirements of the developing countries in the areas of industrial technology, natural resources, and the scientific and technical disciplines. Finally, a series of recommendations are presented encompassing policy, priorities, programming, administration, and suggested action programs for technical assistance in scientific and technical information.

A REVIEW OF THE RELATIONSHIP BETWEEN RESEARCH AND DEVELOPMNT AND ECONOMIC GROWTH/PRODUCTIVITY

National Science Foundation, Division of Science Resources and Policy Studies. W. J. Fellner, Z. Griliches, L. L. Lederman, E. Mansfield, and C. T. Stewart. February 1971. 79 pages.

PB–210 510

The question of what is known about the relationship between research and development and economic growth–productivity is long standing. Both the research and development community and the economics profession have been concerned with the subject for some time. This document is comprised of reviews of the subject by leading researchers in this field. A paper by Steward describes the methodologies employed, the estimates derived, and the results of research on the subject. Mansfield discusses the contribution of research and development to the economic growth of the United States. Fellner's paper is concerned with questions raised from the perspective of his research utilizing the residual methodology in estimating the macro-economic contribution of progress-generating activities. Griliches discusses the evidence for a positive return from R and D, arguments on the underinvestments question, some ideas concerning the allocation of resources, and suggestions for research projects. An introduction to the subject and a summary of the papers is provided by Lederman.

* * *

THE VITA INTERNATIONAL INQUIRY SERVICE. AN EVALUATIVE REVIEW

Agency for International Development, Office for Private Overseas Programs. Richard Morse. March 1972. 156 pages.

PB–210 512

Volunteers for International Technical Assistance (VITA), operates a correspondence service which seeks to provide answers to technical inquiries from individuals in developing countries. Such inquiries are usually assigned to one of 5,500 volunteer experts in the U.S. and other nations for answer. This documents is a result of a study undertaken to gain a better insight into present and potential achievements and problems of this voluntary approach to responding to technical information needs. It is intended for those interested in the task of adapting and transfering technical knowledge effectively; and for those specifically interested in VITA as a privately managed program through which individuals can contribute to overseas development.

* * *

APPLICATIONS OF FUNDAMENTAL MATERIALS RESEARCH

U.S. Atomic Energy Commission, Division of Research. L. C. Ianniello. August 1971. 139 pages.

TID–25798

This report is concerned with the interaction between fundamental research and practical application in the field of materials research. It is comprised of the histories of a number of research projects which were undertaken solely for the purpose of increasing our understanding of solids and liquids, and which yielded results which eventually found specific applications. Over half of the work described was performed since 1965. A brief discussion is included on the overall merit and risk character of the research, to place it in perspective. Some general conclusions are drawn concerning the application of fundamental materials research results.

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1972 ANNUAL SUBJECT INDEX

THE 1972 ANNUAL SUBJECT INDEX IS INCLUDED IN THIS ISSUE OF THE APPLICATION OF MODERN TECHNOLOGIES TO INTERNATIONAL DEVELOPMENT TO PROVIDE USERS WITH A QUICK ENTRY POINT BY SUBJECT MATTER TO THIS AND THE THREE PREVIOUS ISSUES PUBLISHED THIS YEAR. BELOW EACH SUBJECT TERM IS A ROMAN NUMERAL REPRESENTING AN ISSUE IN WHICH AN ITEM CAN BE FOUND. "I" REPRESENTS THE JANUARY 1972 ISSUE; "II" FOR APRIL 1972; "III" FOR JULY 1972; AND "IV" FOR THIS ISSUE. IMMEDIATELY FOLLOWING THE ROMAN NUMERAL IS ONE OR MORE PAGE NUMBERS WHERE ITEMS CAN BE FOUND.

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